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1908

PROCEEDINGS OF THE
OHIO ELECTRIC LIGHT
ASSOCIATION

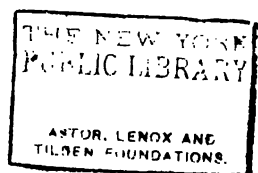


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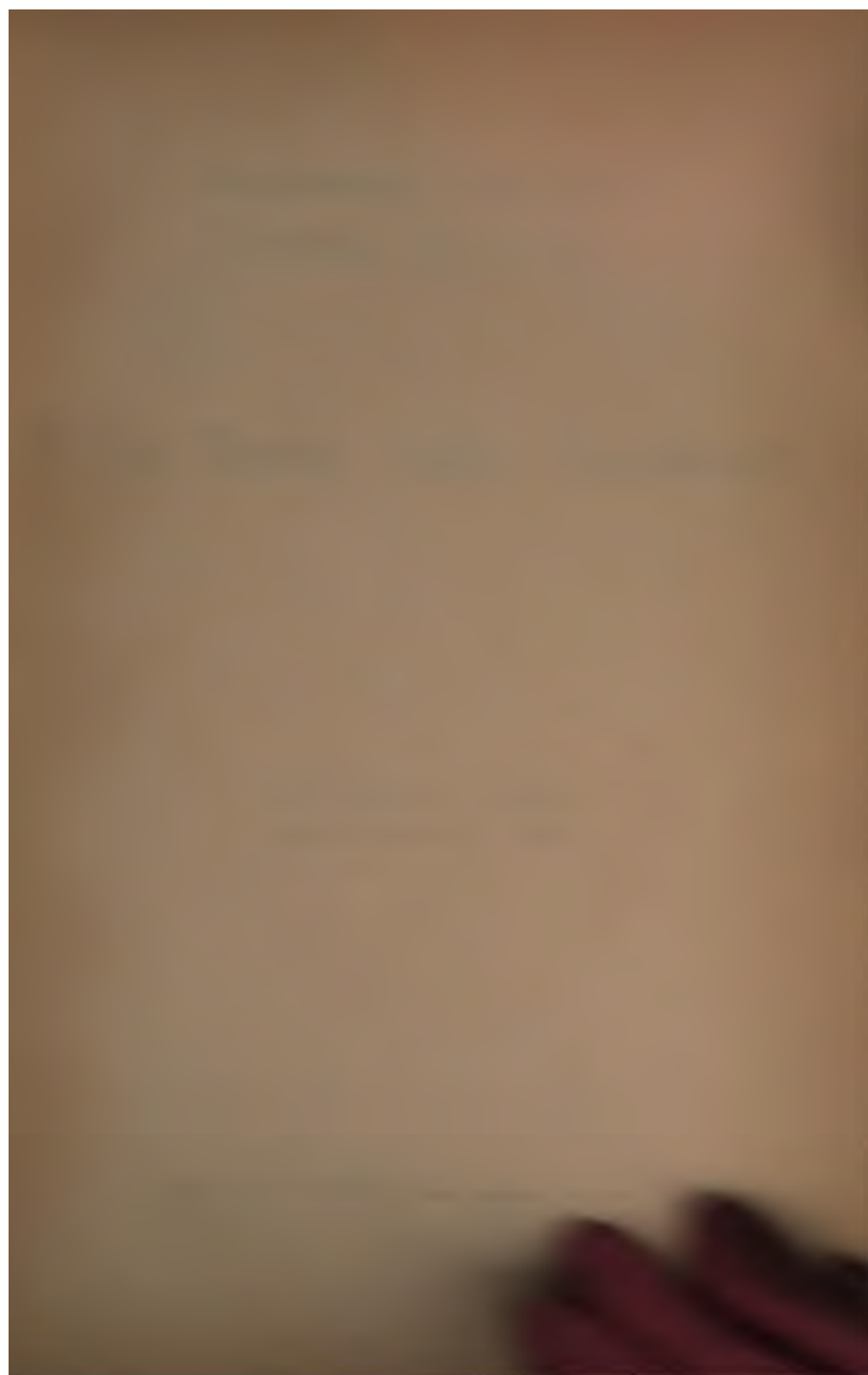








F. M. TAIT, President.
DAYTON, OHIO.





PROCEEDINGS FOURTEENTH
ANNUAL CONVENTION

 Ohio Electric Light Association

PUT-IN-BAY, L. E., OHIO,
August 25, 26 and 27, 1908.

DOUGLAS A. BROWN, Official Reporter, Cincinnati, O.

CHR





OHIO ELECTRIC LIGHT ASSOCIATION.

OFFICERS 1908-1909.

President..... C. R. McKAY..... Toledo, O.
Vice President..... J. C. ROTHERY..... East Liverpool, O.
Secretary-Treasurer..... D. L. GASKILL..... Greenville, O.

EXECUTIVE COMMITTEE.

F. M. Tait, chairman..... Dayton, O.
W. P. Engel..... Defiance, O.
M. E. Turner..... Cleveland, O.
W. F. Hubbell..... Wauseon, O.
L. G. White..... Columbus, O.

ADVISORY COMMITTEE.

Saml. Scovill, chairman..... Cleveland, O.
F. M. Tait..... Dayton, O.
D. L. Gaskill..... Greenville, O.

PUBLICITY COMMITTEE.

E. L. Booth, chairman..... Bellaire, O.
W. A. Wolls..... Columbus, O.
W. C. Anderson..... Canton, O.

FINANCE COMMITTEE.

T. D. Buckwell, chairman..... Toledo, O.
L. C. Anderson..... Franklin, O.
F. D. Elwell..... Sidney, O.

MEMBERSHIP COMMITTEE.

W. J. Hanley, chairman..... Cleveland, O.
C. B. Rogers..... Tiffin, O.
H. H. Cudmore..... Cleveland, O.
G. E. Miller..... Cleveland, O.
C. M. Lott..... Hicksville, O.



F. M. TAIT, President,
DAYTON, OHIO.



Gallipolis Gas & Electric Co.....	Gallipolis
The Alliance Gas & Electric Co.....	Alliance
The Ada Water, Heat & Light Co.....	Ada
Columbus Public Service Co.....	Columbus
The Jamestown Electric Light Co.....	Jamestown
The United Electric Co.....	Dennison
Citizens Gas & Electric Co.....	Elyria
Bucyrus Gas & Electric Co.....	Bucyrus
Columbus, Delaware & Marion Railway Co.....	Delaware
The Bellevue Illuminating & Power Co.....	Bellevue
The Dayton Lighting Co.....	Dayton
The Salineville Electric Light, Heat & Power Co.....	Salineville
The Fisher Light & Power Co.....	Forrest
Delphos Electric Light & Power Co.....	Delphos
The Franklin Electric Light Co.....	Franklin
The Loveland Citizens Electric Co.....	Loveland
The Wilmington Water & Light Co.....	Wilmington
The Ottawa Electric Light Co.....	Ottawa
The Tiffin Edison Illuminating Co.....	Tiffin
The Kent Water & Light Co.....	Kent
The Cambridge Power, Light & Traction Co.....	Cambridge
The East Liverpool Traction & Light Co.....	East Liverpool
The Ohio Electric Railway Co.....	Cincinnati
The Pomeroy & Middleport Electric Co.....	Pomeroy
The McConnellsville Malta Electric Co.....	McConnellsville
The Oak Harbor Electric Co.....	Oak Harbor
The Bellville Electric Light Plant.....	Bellville
The Wadsworth Light & Water Co.....	Wadsworth
The Hicksville Electric Light & Power Co.....	Hicksville
The Maumee Electric Co.....	Maumee
The West Liberty Electric Light Plant.....	West Liberty
The Chillicothe Electric Railway, Light & Power Co.....	Chillicothe
The Home Light, Power & Heating Co.....	Springfield
The Citizens Light & Power Co.....	Xenia
The Fremont Yaryan Co.....	Fremont
The Tuscarawas County Electric Light & Power Co.....	New Philadelphia
The Eaton Electric Light, Power & Ice Manufacturing Co.....	Eaton
The Wooster Electric Co.....	Wooster
The Lexington Electric Light Plant.....	Lexington
The Cleveland Light & Power Co.....	Cleveland
The Ashland Gas & Electric Light Co.....	Ashland
The Bridgeport Electric Light & Power Co.....	Bridgeport

ASSOCIATE MEMBERS OF THE OHIO ELECTRIC LIGHT ASSOCIATION.

The F. Bissell Co.	Toledo, O.
Post-Glover Electric Co.	Cincinnati, O.
Doubleday-Hill Electric Co.	Pittsburg, Pa.
Buckeye Electric Co.	Cleveland, O.
John A. Roebling Sons' Co.	Cleveland, O.
Wagner Electric Manufacturing Co.	St. Louis, Mo.
Adams-Bagnall Electric Co.	Cleveland, O.
Central Electric Co.	Chicago, Ill.
Western Electric Co.	Cincinnati, O.
The Illinois Electric Co.	Chicago, Ill.
Westinghouse Electric & Manufacturing Co.	Pittsburg, Pa.
Ft. Wayne Electric Works.	Ft. Wayne, Ind.
The Erner Electric Co.	Cleveland, O.
W. G. Nagel Electric Co.	Toledo, O.
Fass & Seymour.	Solvay, N. Y.
Cleveland Electrical Supply Co.	Cleveland, O.
The Erner-Hopkins Co.	Columbus, O.
Electric Appliance Co.	Chicago, Ill.
Westinghouse Machine Co., Westinghouse Bldg.	Pittsburg, Pa.
W. J. Hanley, for General Electric Co.	Cleveland, O.
H. R. Fowler.	Toledo, O.
Bryan Marsh Co.	Cincinnati, O.
Hart Manufacturing Co.	Hartford, Conn.
F. D. Lawrence Electric Co.	Cincinnati, O.
National Carbon Co.	Cleveland, O.
Sanderson & Porter, 52 Williams St.	New York City, N. Y.
Westinghouse Electric & Manufacturing Co.	Cleveland, O.
The Banner Electric Co.	Youngstown, O.
Nernst Lamp Co.	Pittsburg, Pa.
Library Bureau.	Cleveland, O.
Allis-Chalmers Co.	Milwaukee, Wis.
American Circular Loom Co.	Chelsea, Mass.
Pittsburg Transformer Co.	Pittsburg, Pa.
Shelby Electric Co.	Shelby, O.
Co-Operative Electrical Development Co.	Cleveland, O.
Westinghouse Electric & Manufacturing Co.	Cincinnati, O.
The C. W. Lee Co.	Newark, N. J.
The Toledo Chandelier Manufacturing Co.	Toledo, O.
Western Gas Fixture Co.	Toledo, O.
The Curtis Advertising Co.	Detroit, Mich.
The Electric Supply & Construction Co.	Columbus, O.
The Globe Electrical Co.	Dayton, O.

The Morreau Gas Fixture Manufacturing Co.....	Cleveland, O.
W. G. Woolfalk	Youngstown, O.
The John A. Stewart Electric Co.....	Cincinnati, O.
The Cleveland Gas & Electric Fixture Co.....	Conneaut, O.
The Brilliant Electric Co.....	Cleveland, O.
The Toledo Electric Co.....	Toledo, O.
The Excello Arc Lamp Co.....	New York, N. Y.
The Holophane Co.....	New York, N. Y.
The Jandus Electric Co.....	Cleveland, O.
The Ambos-Cudmore Co.....	Cleveland, O.
The George Worthington Co., Electrical Dept.....	Cleveland, O.
The Wm. D. McKunkin Advertising Agency, 187 Dearborn St.....	Chicago, Ill.
National Metal Moulding Co.....	Pittsburg, Pa.
The Indiana Rubber & Insulated Wire Co.....	Jonesboro, Ind.
The Duncan Electric Manufacturing Co.....	La Fayette, Ind.
The Federal Electric Co., Lake and Desplains Sts.....	Chicago, Ill.
The American Electrical Works, 135 Adams St.....	Chicago, Ill.
The Standard Underground Cable Co., Central Sales Dept., Westinghouse Bldg.....	Pittsburg, Pa.
The Diamond Rubber Co., Insulated Wire Dept.....	Akron, O.
The American Electrical Heater Co.....	Detroit, Mich.
The Union Electric Co.....	Pittsburg, Pa.
The Cutler Hammer Co.....	Milwaukee, Wis.
The Ideal Electric & Manufacturing Co.....	Mansfield, O.
The William Hall Electric Co.....	Dayton, O.
The Simplex Electric Heating Co.....	Cambridge, Mass.

Since the organization of the Ohio Electric Light Association the following gentlemen have filled the office of president:

1895-1896—A. W. Field.....	Columbus, O.
1896-1897—John I. Beggs.....	Cincinnati, O.
1897-1898—H. K. Wood.....	Piqua, O.
1898-1899—Emil G. Schmidt.....	Sandusky, O.
1899-1900—D. L. Gaskill.....	Greenville, O.
1900-1901—Ernest J. Bechtel.....	Toledo, O.
1901-1902—W. F. White.....	Cincinnati, O.
1902-1903—A. W. Field.....	Columbus, O.
1903-1904—J. H. Perkins.....	Youngstown, O.
1904-1905—M. E. Turner.....	Cleveland, O.
1905-1906—F. E. Valentine.....	Piqua, O.
W. E. Russell, Acting, Massillon, O.	
1906-1907—W. P. Engle.....	Defiance, O.
1907-1908—F. M. Tait.....	Dayton, O.
1908-1909—C. R. McKay.....	Toledo, O.

Since the organization of the Association its meetings have been held at the following places:

Piqua.....	October 8-9, 1895.
Springfield.....	October 13-14, 1896.
Cincinnati.....	October 12-13, 1897.
Sandusky.....	August 18-19, 1898.
Cleveland.....	August 10-11-12, 1899.
Toledo.....	August 14-15-16, 1900.
Hotel Victory, Put-In-Bay.....	August 20-21-22, 1901.
Columbus.....	October 14-15-16, 1902.
Columbus.....	October 13-14-15, 1903.
Sandusky.....	August 16-17-18, 1904.
Hotel Victory, Put-In-Bay.....	August 16-17-18, 1905.
Hotel Victory, Put-In-Bay.....	August 21-22-23, 1906.
Toledo.....	August 20-21-22, 1907.
Hotel Victory, Put-In-Bay.....	August 25-26-27, 1908.

PROCEEDINGS FOURTEENTH ANNUAL MEETING

OHIO ELECTRIC LIGHT ASSOCIATION.

The Fourteenth Annual Meeting of the Ohio Electric Light Association was held at Hotel Victory, Put-in-Bay, Ohio, on August 25, 26 and 27, 1908, under the presidency of Mr. F. M. Tait, of the Dayton Lighting Co.

The following is a stenographic report of the proceedings:

First Session—Tuesday Afternoon, August 25.

President Tait being unable to reach the Bay for the afternoon session, Secretary Gaskill called the convention to order at 2:30 p. m., and announced that Ex-President W. P. Engel, of Defiance, would preside until the arrival of President Tait.

Ex-President Engel (in the chair): Gentlemen, inasmuch as Mr. Tait has been called away and will not return until this evening, we will defer his address until tomorrow, so as to give him the opportunity to deliver it himself.

The first paper of the afternoon will be presented by Mr. William M. Adams, of the Citizens Gas & Electric Co., Elyria, O.

The paper was read by Mr. Adams, as follows:

THE GAS ENGINE

BY WM. M. ADAMS, Citizens Gas & Electric Co., Elyria, Ohio.

MR. Chairman, Members and Visitors—The subject that is my lot to discuss before you at this time is one of unusual interest, and is bound to become an important factor in the manufacture and sale of electric light and power.

The gas engine as we find it to-day has come to fill a long felt want that cannot be supplied by any other prime mover, namely the converting of heat energy into work with a minimum loss. It is a well known fact that the average steam engine delivers less than 5 per cent of the energy in the coal in the form of useful work. Note the contrast with the gas engine which delivers more than 25 per cent of the energy in the fuel in the form of useful work. To my hearers who are not engineers these statements will sound rather unwarranted and for that reason the following explanations will be in order: Let us see first why the steam engine furnishes less than five per cent of the energy in the coal. We will take for an illustration of a typical steam plant of say 300 h. p. We will suppose that the plant is equipped with horizontal tubular boilers, standard feed pumps and heater, automatic high speed engine.

The coal, we will suppose, has been delivered to the boiler room in car load lots, and is of good quality containing 12000 B. T. U. per lb. We will find upon investigation that one pound of coal burned under the boiler in this instance will evaporate 5 pounds of water from at 212 Fahr. Experience has also proven that an engine such as we have specified will consume 30 lbs. of steam per h. p. hour, and the coal burned evaporates 5 pounds of water per pound of coal, it is clear that 30 divided 5 equals six pounds of coal required to be burned per hour per h. p. output.

We said at the start that each pound of coal contained 12000 heat units, therefore 12000 times 6 equals 72000 heat units in the form of coal that has been purchased to furnish one h. p. of energy ready for sale.

One heat unit is equivalent to 778 foot pounds of energy, and one h. p. is equivalent to 33000 foot pounds per minute, therefore 33000 divided by 778 and the quotient multiplied by 60 equals 2,545 divided by 7200 equals 3 ½ per cent of the energy in the coal delivered in the form of useful work. 96½ per cent of the money spent for coal is a total loss, part due to improper combus-

tion in the furnace, part goes up the smoke stack, a part in radiation in pipe lines, and part in combustion in the engine

The above case is typical of the actual conditions where a plant is operated with care and skillful attention.

In cases where the plant is not carefully handled, where the boiler is allowed to scale and thus become coated with soot, the piping and fittings allowed to become leaky, and the engine allowed to become out of adjustment, valves and pistons leaky, all these items add to the inefficiency of the plant and lower the per cent of useful work obtained from the fuel purchase.

Let us next consider the case of the gas engine. We said in the start that over 25 per cent of the energy in the fuel could be delivered by the engine in useful work. Let us see why. We will consider a typical gas engine plant of say 300 h. p., the engine being a standard make of gas engine, guaranteed to operate on 10 cubic feet of gas per h. p. hour and using natural gas of a thousand B. T. U. per cubic foot. Upon investigation, and test we find this plant operating upon $9\frac{3}{4}$ cubic feet of gas per h. p. hour, and upon analyzing the gas find it to contain 960 B. T. U. per cubic foot, therefore $9\frac{3}{4}$ times 960 equals 9360 heat units of energy delivered to the engine in the form of natural gas for which is obtained one h. p. of energy delivered by the engine ready for sale.

We found in the former illustration that 2545 heat units equal one h. p. therefore 2545 divided by 9360 equals 27 per cent of the energy in the fuel delivered by the engine in the form of useful work ready for sale, as against $3\frac{1}{2}$ per cent under same conditions with a steam plant. From these remarks there should be no question why the gas engine should not surpass the steam engine as far as economy in use of fuel consumed. Let us see if there are any further advantages in the gas engine over the steam engine.

A great deal has been written and said about the unreliability of the gas engine in service. Did it ever occur to any of you how unreasonable such criticisms are and upon what weak foundations such are based? I am prepared to say at this time it can be shown beyond a doubt, that the gas engine of to-day is a great deal more reliable than the steam plant, that a great deal less attention is required to keep a gas engine plant in perfect condition than is required for a steam plant of equal size, further that the chances of failure of the gas plant are a great deal less than the steam plant. With the gas engine plant we eliminate entirely the steam boiler trouble with all its faults. As far as the engine itself is concerned it has its delicate points such as the ignitor, etc. The gas engineer that does not frequently examine the ignition system, keep his magnates and battery in order would also let his steam plant get out of order. With the gas plant the only parts that need attention is the ignition system. There is no piston rod or valve stem, stuffing boxes to be packed or to blow steam.

J. J.

In summing up the gas engine there seems no good reason why it should not appeal to the electric light association as an economical, reliable and efficient prime mover, and to the prospective purchaser of additional power units the installation of the gas engines where natural gas is available should be seriously considered by progressive managers for its very low cost as well as its reliability. Where natural gas is not available, the question of producer gas in connection with gas engines should be considered before a steam plant is installed. Bituminous coal gas producers are now an assured fact. They are the only apparatus that will deliver a h. p. from one pound of coal, and while the first cost of a producer gas engine will slightly exceed the cost of a steam boiler and engine, the saving in fuel alone will more than pay for the difference in investment the first year.

Discussion.

Ex-President Engel: I think Mr. Adams has given us a paper upon which we have all been more or less very solicitous to know more. He has made some statements that we all realize are radical, but we also believe that he has had sufficient experience to know what he is talking about, and we are anxious to hear questions asked by any member present, and to have a full discussion.

S. F. Messer (Warren): I would like to ask Mr. Adams about what price he has to pay for gas?

W. M. Adams (Elyria): 25 cents for gas engines. That is what our company charges all over the district.

W. C. Anderson (Canton): I would like to ask if under equally high pressure a gas engine is as reliable as a steam engine?

W. M. Adams (Elyria): As to that I will say that we have run two engines since a year ago last April and have never lost one minute's time during all that period. Last spring we remodeled the plant entirely and never shut down one minute.

Secretary Gaskill: What make of engines have you?

W. M. Adams (Elyria): We have two Westinghouse three-cylinder, one Struthers-Wells of 258 horsepower; the Westinghouse is rated at 280 horsepower.

W. C. Anderson (Canton): I might say that we had a case in our town not very long ago of a gas engine of about 125 horsepower blowing up and killing the engineer.

W. M. Adams (Elyria): So you hear sometimes that a steam boiler blows up and kills the engineer; but if the engineer will take care of his ignition and give to the gas engine just half of the attention that he would give a steam engine, he will not have any trouble. We run our engines 24 hours a day, 365 days in the year.

Wm. Wolls (Columbus): Mr. Adams seems to put great stress on the ignition. What method of ignition do you have on your gas engines?

W. M. Adams (Elyria): We start our engine on a battery. We use an Edison battery. We take the ignition off the exciter.

Wm. Wolls (Columbus): Do you have a duplicate system of ignition, or just single?

W. M. Adams (Elyria): Single system. We have a duplicate set of batteries so as to provide for a battery giving out. We switch over on the other battery to start, and then use the exciter.

H. O. Dutter (Bucyrus): I would like to hear what the speaker's compression is on his engines, and also what his explosion is: does he use an indicator to keep in touch with his explosion and his compression pressure and also the working of the valve, or does he just leave that with his engineer? The point was brought up in my place the other day by a certain electrical engineer to the effect that anybody could run a steam engine, but it took a

good man to run a gas engine. I would like to know what Mr. Adams experience is?

W. M. Adams (Elyria): It is true that it takes a good man. We pay more for gas engineers than for steam engineers when we find the right man. We do not pay much more. Where we could get a steam engineer for \$65.00 we pay \$70.00 or \$75.00 for a gas engineer. I have not the data with me as to that now. We made all those tests. This engine was guaranteed. I was pretty careful about getting that. The guaranty was 250 horsepower, 25 per cent over-load. It ran 25 per cent over the guaranty. During one period of 24 hours it ran all the way from 250 to 330 horsepower under water rheostat test.

J. R. Cravath (Electrical World): I would ask if you have had any difficulties due to the great variations that sometimes occur in natural gas pressure; and if you have not, what means do you use for insuring a steady pressure at the engine?

W. M. Adams (Elyria): The great trouble with gas engineers and gas engine builders is that when installing gas engines they do not provide a sufficiently large gas supply pipe. You do not provide a sufficiently large gas supply pipe. You do not need pressure, but you must have volume; you can operate at almost atmospheric pressure. We do not care to have over that. But you have to have a large intake, so that the engine will not be sucking the reservoir empty. We take our gas right off the city main at low pressure.

J. R. Cravath (Electrical World): Is there much variation in your city main pressure?

W. M. Adams (Elyria): Of course there is a little variation, but we cut the pressure down.

J. R. Cravath (Electrical World): The reason I asked that question is that I have personal knowledge of a case where we have had considerable trouble with great variation in the city line pressure and consequently greater variation in the pressure at the gas engine than our regulators could take care of, which of course resulted in bad regulation all round.

W. M. Adams (Elyria): I find that trouble exists. I know of two cases where you can not make the parties change the small for a larger pipe. They installed five 125 horsepower engines in an automobile works about a year ago last spring. I told the superintendent not to make that mistake of putting in too small a pipe, but to make it plenty large enough. He said: "All right Adams, it is up to you." Instead of his putting in a two-inch pipe I made him put in a six-inch. He has never had a day's shut-down, no not a minute. He put a six-inch pipe clear to his engines, and he had a great big reservoir in back of the boiler tank besides. It is not pressure you want, but volume.

H. O. Dutter (Bucyrus): When you are working those gas engines in multiple, how do they behave?

W. M. Adams (Elyria): When we bought those engines all the gas engineers predicted that it would be a failure. Our first two were three-cylinders, and the last is a two-cylinder horizontal engine. When that verdict was pro-

nounced we got the blues. Everybody told us that the company had made a mistake in installing a horizontal engine. We wrote to the engine builders and they assured us that they would stand by their guaranty and told us to pay no attention to what our competitors might say, that if they failed to make good they would pay the damage. Previous to installing the last engine you could see a little bit of a blinking in the light, although this was not observable until after looking at it closely. It was more noticeable in the 2 to 4 candle-power lamp. The night that we first started this engine everybody was down there to see it and considerable interest was manifested. We started in with one, then the three-cylinder, and tried them in every possible way, and there was no more flicker.

F. D. Elwell (Sidney): Where I am located (Sidney) we have two Westinghouse gas engines, three-cylinder uprights of medium size. We found it was largely a matter of education. When we first put those engines in we needed a great deal of education to handle them. The ignition system and other things gave us a great deal of trouble. We spark from the exciter through lamps, and also from a set of storage batteries. We have found that as long as we exercise "eternal vigilance" we do not have any serious trouble, they are as reliable as steam engines—as long as nothing breaks; but there are so many small parts that no amount of "eternal vigilance" will guard against occasional breakage. We have had a few shut-downs where we did not see how we could possibly have foreseen trouble. We have also two steam engines, one of which will run during our peak. We keep up steam all night in the steam engines, ready to cut them in if necessary but rarely do we have to do that; but we have not found that we could dispense with our steam engines. I would like to ask the brother what means he takes to keep the jackets clear of lime?

W. M. Adams (Elyria): Fortunately we are pretty well prepared on the water question. We have two large gas tanks that will hold about 450,000 gallons each. I have a big pump that was made in Canton, and I force the water out of the bottom of one of these tanks and let it flow through the engines into the other tank, and out of that tank into a small tank, in that way using the water over and over again; so that we are not bothered with any lime.

D. J. Hard (Cleveland): I want to ask a question which may expose my ignorance, but we are here to learn. I would like Mr. Adams to state whether with gas at a price which will make the cost of the current generated the same as it would be if generated by coal, is there any advantage in using a gas engine?

W. M. Adams (Elyria): None except the great advantage of economy.

D. J. Hard (Cleveland): Is it any more economical to use a gas engine for other reasons besides the cost of the fuel?

W. M. Adams (Elyria): My paper states, I think you will find, that when this engine was bought it was guaranteed to develop 1 horsepower per hour on 10 feet of gas. On a three-quarter load when you put the current on it con-

same 8.6 feet gas per horsepower hour. I do not think that you can do that with coal.

D. J. Hard (Cleveland): That does not quite answer my question. Suppose that it costs 2 cents to generate electricity by coal and the same amount to generate it by gas, what would be the economy in the use of gas over steam?

W. M. Adams (Elyria): It does not cost that. I have stated in my paper that the producer is bound to come into use. Unfortunately up there we are a long way from the gas fields—about 150 miles—and the line coming past is pretty well crowded. At the field they have about 285 pounds, near Mt. Vernon; and by the time it gets up to Elyria I have seen the pressure down to 3 pounds. This firm that told you about has just installed in the last three or four months a soft coal producer, not to compete with natural gas, but to be sure that he could have something to fall back upon in emergency; and that same general superintendent up there told me that it was very satisfactory so far as economy was concerned. I can not give the name of the soft coal producer. They have always been working on hard coal; but this is a soft coal producer costing \$15,000 or \$18,000. If it does not produce results more cheaply than steam why do they use it? That is an individual plant.

D. J. Hard (Cleveland): Suppose the gas is furnished at a figure that would make it cost the same to produce current as by steam, is there any other economy?

W. M. Adams (Elyria): No, not that I know of.

Ex-Prest. Engel: I hardly think you understood the question. Do you not consider that you are still making a saving over the steam engine in cost of labor in looking after steam pipes, pumps, etc?

W. M. Adams (Elyria): That, of course, is all dispensed with.

Ex-Prest. Engel: That is the idea. We want to know whether electricity can be furnished for the same money by steam if it costs the same money to produce 1 horsepower with gas. We realize that there is an economy with your low price of gas now; but if the gas people should make the price equal to that of coal how much would there still be saved in favor of the gas, that is the gentleman's idea?

W. M. Adams (Elyria): We run our plant which in the evening at peak load is about 500 horsepower, with 3 men for the 24 hours. That is on the inside; that has nothing to do with taking care of lamps and other work on the outside. We have three engineers.

Ex-Prest. Engel: Your conclusion is then, that a 500 horsepower plant can be operated by gas engine with three men for the 24 hours?

W. M. Adams (Elyria): Yes, sir.

Ex-Prest. Engel: And the steam men now must judge whether they can operate a 500 horsepower plant 24 hours a day with three men, considering that they must have a fireman, engineers, and so forth. Is there anything further of importance on this paper? Mr. Adams has been a very willing advocate of gas engines, and he likes to answer questions.

H. O. Dutter (Bucyrus): One more question: Can the gentleman give us

any idea of the comparative life of the two engines so to speak? In other words, if a man invest \$10,000 in installing a gas engine, or an equal amount to put in steam to give the same power, which one of those two engines is likely to give him the longest life on the money invested?

W. M. Adams (Elyria): That is pretty hard to answer. It depends upon the care taken. As I say, this engine has now been running, two of them over four years with scarcely any repairs. Of course it has had proper attention. And that brings up the point that one fault with the gas engine is that the operation is so uniformly good that the engineer gets lazy; but with a good man in charge there is no reason why a gas plant should not last as long as a steam plant.

Ex-Prest. Engel: For the benefit of those who may not have heard Mr. Adams, I would state that he says he can see no difference in the wear or the life of a gas engine as against a steam engine if equal care is given to each. If there is nothing further on this paper we will go on to the next, which is a "Report on Gas Producer and Oil Engine Plants" contributed jointly by Mr. B. H. Smith, of the Lexington Electric Plant, and Mr. B. H. Gardner, of the Dayton Lighting Plant.

Secretary Gaskill: I would state that Mr. Smith notified us that he would be present. He is not here now, but I hope will arrive by tomorrow morning. I would suggest that if any questions arise in your mind regarding Mr. Smith's paper that you reserve them until his arrival. Mr. Smith is superintendent of the Lexington, O., Electric Light Plant, which is one of the few electric light plants that are running a gas producer plant. This plant has just made application for membership in this Association.

In the absence of Mr. Smith at this time, his paper was read by Secretary Gaskill, as follows:

Report on Gas Producer Plant

By BOYD H. SMITH, Lexington Electric Light Plant, Lexington, Ohio.

The present power equipment of the Lexington Electric Light Plant consists of a 25 h. p. Suction Gas Producer and a 100 h. p. Producer Gas Engine. The dynamo is a 17 k. w., 125 Vt. D. C. machine similar to others of its kind.

The power generating portion of the plant is not a typical installation. The producer is an antiquated type, built in 1902, using anthracite coal. Modern gas generators have many improvements over this one that simplify their operations and increase their efficiency.

The load on the plant varies from 15 h. p. to 35 h. p. and, therefore, the producer is over driven during the peak load, causing the gas to be of a lower quality, during that part of the run, than it would be in a machine of proper size. It is so constructed that the fire cannot be barred while in operation, and the operator is handicapped in this way in case the fire should start to channel. Although this proves a serious trouble at times, it seldom happens when proper care is taken while preparing for the run.

The engine is operating under one-third load most of the time, and this makes a marked reduction in the efficiency of the equipment.

The fuel consumption varies somewhat with different grades of coal. We have used coal from several different mines, but get the best results from pea size Bernice anthracite, which we are using at present.

With an average load of 10.2 k. w., about $1\frac{1}{2}$ h. p., and a run of $\frac{1}{4}$ hours, we consume 271 lbs. of coal including a standover loss of three pounds per hour. Deducting 56 lbs. for standover, the fuel consumption during the run is 215 lbs., 2.2 lbs. per h. p. hour, or four pounds per kilowatt hour. With coal at \$4.90 a ton the cost for fuel is 1c per kilowatt hour. The entire cost including oil, attendance, etc., is 4c per kilowatt hour.

Many modern producer gas plants are running with at least one-half this amount of fuel, and therefore it is not difficult to see why all installations of this kind should not be compared with this one.

The preparation of the plant for the run takes about an hour. Oiling the engine, cleaning, and timing the ignitors, cleaning, barring and blowing the fire in the producer sums up the usual preparatory service. Of the attention

given the plant after starting, the engine received the greater part. During regular runs all the attention to it that is usually necessary is noting the condition of the bearings, oiling, etc., but, with an increase in load we experience some trouble from superheating of the exhaust valves. We are now preparing water cooled exhaust valves and hope to obviate this difficulty in that way.

The ignitors, a common weakness in gas engines, have given little trouble.

As to reliability, may it suffice to note that many times the operator has to leave the plant to take up the reins of another department and it is not an uncommon occurrence for it to run unattended for an hour at a time with no variation in the operation of the plant. While this is not good policy, one, in so small a plant, has to act in all capacities.

The fire seldom has to be drawn from the producer except to make some repairs that cannot be done otherwise. It has been nearly six months since our fire was drawn, and then it was done that we might replace a broken bosh plate.

The repairs on the producer have not exceeded five dollars a year. The up keep of the engine will probably amount to \$30 a year.

The increasing population of our town, the growth of business done in it, and the corresponding increase in the lighting to be done, will probably enable us to equip our plant with a modern producer gas installation. We will then be able to give a more complete, and therefore more interesting report of our operations.

The rapid progress now being made in the Gas Producer and Gas Engine will, no doubt, bring them to the front in the power equipments of the near future.

Is

Ex-Prest. Engel: The members will remember that any questions they desire to ask on this paper may be brought up tomorrow morning when Mr. Smith arrives. We will hear from Mr. Gardner, whose paper on the same subject deals with a plant operated by oil engine located in a city other than that in which he is located. I think you will find that he has made a very careful investigation of the conditions.

Mr. Gardner read his paper as follows:

Report on an Oil Engine Plant in a City of 10,000 Inhabitants.

BY B. H. GARDNER, Dayton Lighting Company, Dayton, Ohio.

The station equipment consists of two 225 horse power vertical, three cylinder oil engines, direct connected to 160 k. w., 2300 volt, 3 phase, 60 cycle, Fort Wayne Alternators. The engines are 16" x 24" and speed is 164 R. P. M. The exciters are belted, are of 15 k. w. capacity, 125 volts, and are also of Fort Wayne manufacture. The special compressors are also belted to engines, there being one compressor to each engine. The switchboard is of General Electric manufacture. There are also three fifty light A. B. constant current transformers. The cost of this plant installed complete, exclusive of buildings, was stated to be \$44,000, or approximately one hundred and thirty-eight dollars per kilowatt of capacity.

Their connected load consists of the following:

156—7. 5. amp. series A. C. street arc lamps on all night service.

90—32 c. p. lamps in alleys, etc, on all night service.

36—16 c. p. lamps in engine houses, etc.

The above are all furnished to the city. In addition to this, the commercial load is as follows:

194 horse power in 220 volt, 3 phase A. C. motors 8000 to 9000—16 candle power incandescents, (estimated.)

33—6 amp. multiple A. B. arc lamps.

There are a few signs in the city, but they are all on regular meter rates, no concession being given for signs or windows being burned over long hours, and signs are not switched on or off by the company.

Water works, gas works, and electric lighting plant all owned and operated by the city. There is no natural gas and never has been any in this locality. Both the gas works and the lighting plant being owned by the city, there is no competition, and practically no effort to secure new business. The store lighting is about equally divided between the gas and electric plants. There are a few gas engines in town, but there have been a number replaced with electric motors. There has been no special effort along this line, the consumers taking the step themselves when the engines became too troublesome.

The electric company does no inside wiring at all. Does not furnish free lamp renewals, or free repairs, although occasionally a consumer who does not understand the operation of his motor is given a helping hand. The company does trim the commercial ares without charge. They do not carry supplies of any kind, and do not push the sale of any current consuming devices.

The plant has been in operation a little over two years, and they claim that during this time there has not been a single shut down, and that the repairs all told, have amounted to only two hundred and fifteen dollars [\$215.]

One man reported that he had to keep after the engines all the time to keep them in first class condition, for, unless they were in a number one shape, they would not operate. The other man reported that they were very little trouble, and did not need any more attention than a steam plant. The regulation on the engines is sufficiently close to allow them to be operated in parallel, as they are every night, and while running under an absolutely steady load the regulation is all that one could desire, as there is no perceptible variation whatever. Under a fluctuating load however, there is much room for improvement, as the regulation is much poorer than a steam engine of equal size would give. For instance, with the engines operating at about one-third load, a variation of five amperes on primary meter, caused by elevator motor without starter would cause a drop of 8 to 12 volts on secondary circuits. Everything considered, the regulation is not very good, as variations of voltage were noted amounting to twenty per cent; this without the field rheostat being touched, and under slightly fluctuating loads.

For fifteen months, ending March, 1908, the average monthly kilowatt hour output of this plant was fifty-four-thousand-two-hundred and the average oil consumption was eleven and two-tenths gallons per one-hundred k. w. hours. The cost of oil delivered is three and one fourth cents per gallon. The labor of three men to run the plant amounts to two-hundred and forty dollars per month. This includes the time that one man spends in trimming and repairing both street and commercial ares.

Regarding the water used for cooling no definite information could be obtained on this point, for as the city supplies the water free of charge, it is not metered, and no one knows what it amounts to. However, it probably will exceed in amount that necessary for a gas engine of equal size.

REPORT ON PRODUCER GAS PLANT AT A SMALL BOX FACTORY, IN DAYTON, OHIO.

The manager of the Box factory was approached by representatives of The Dayton Lighting Company before their new building was erected. He had

used a gas engine previously and was afraid of the cost of operating with motor drive, and finally decided to put in a producer gas plant. The producer, etc., is of Fort Wayne manufacture, while the engine itself was manufactured by the Callahan Gas Engine Company, of Dayton.

From the very first the installation was the source of much annoyance and lost time, it often being nine or ten o'clock before the attendants would succeed in starting the engine, resulting in twenty or thirty workmen being idle from two to three hours, three to four days per week.

After several months' operation the producer was abandoned altogether and the engine was run with gasoline, while the entire producer was cleaned and overhauled. About this time the engine and producer manufacturers had a lengthy squabble, each trying to lay the unsatisfactory operation at the other's door. Finally, the producer was made to work fairly satisfactorily by starting the engine with gasoline and using gasoline for about two hours, when the producer will begin to deliver gas, and for the balance of the day the engine will run off of producer gas.

As no guarantee was given except as to the cost of fuel, which has been met, there is no loop-hole of escape and they must keep the producer plant. The manager stated, however, that he realizes he made a great mistake in not putting in a motor in the first place, as the time they lost the first six months would pay for electric power for a year. He has no confidence whatever in his plant, and feels that it is only a question of a short time before it will be junked and replaced with electric drive.

The Box Company is considering building an addition to their present plant, and they state if they do so, they would not under any circumstances, consider anything but electric power.

This Box Company's experience with a producer plant has kept at least one plant and probably more, from being sold in Dayton and the box company has turned to be a good booster for electric power.

Discussion.

Secretary Gaskill: Mr. President, probably it is well to make some explanation of Mr. Gardner's paper. At the meeting of the Executive Committee held in Columbus last January it was decided to devote the first session to papers on prime movers, and to cover in the papers a gas engine, a gas producer plant, and an oil engine plant, if possible. The only oil engines that we could find in the immediate vicinity of such size as to warrant investigation were those located in this city, and I might say the city is Bellefontaine, O. Mr. Tait took charge of the matter, and Mr. Gardner acting under the instructions of Mr. Tait went to that city and made the necessary examination and investigation upon which to base his paper. The plant at Bellefontaine, as you know, is a municipal plant. Of course such plants are not admitted as members, and they would have no opportunity of presenting the subject from their viewpoint. Besides that we wanted the report to come from a disinterested party. That is why the paper comes from Dayton; in justice to the Dayton Lighting Co. you will understand that they have no connection with the municipal plant.

Ex-Prest. Engel: Are there any questions to be asked Mr. Gardner? We are aware that we are up against these things as central station men. We have received considerable literature as to what the oil engine will do. We have with us at the convention a gentleman from Bryan, O., which is also a municipal plant that is running oil engines. If he is present in the room we would like very much to hear from him.

S. E. Folk (Bryan): Do you ask for a report from Bryan?

Ex-Prest. Engel: Yes, we want to hear what your engine is doing. It is a Diesel engine, I believe.

S. E. Folk (Bryan): We have been operating a Diesel engine for about a year to our entire satisfaction. I followed Mr. Adams' remarks very closely and found the statements he made to be in harmony with our experience along the line of engineers. We find that steam engineers are not as successful with the Diesel engine as they might be, because they do not study their engine and get closely enough in touch with it. The economy of the engine has been remarkable, we put in current on the switch-board at $3\frac{1}{2}$ to 4 cents per k. w. hr., including interest on sinking fund, labor, fuel and all operating expenses. The duty has been all that we could desire. We have not been obliged to shut down at any time from any cause whatsoever. The maintenance has been much less and the labor less than with the steam engine that we had previously. Our plant was formerly equipped with a Russell engine, which gave us trouble through leaking valves and things of that kind. We deal with very high pressures, and have had no trouble whatever. One gentleman asked in regard to safety pressures. Our pressures run up as high as 1,000 pounds per square inch, but we keep them low. We have no igniters in the Diesel engine. The Diesel engine varies a good deal from the ordinary gas engine in its principles. We do not mix any fuel with the air before it goes to the cylinder. We take in a charge of pure air and compress

it to 500 pounds per square inch. The compression heats the air hot enough to ignite the fuel, and it is injected in the cylinder. On the peak load we compress the injection air to 1,000 pounds that is used for injecting fuel into the cylinder. As stated, we have no trouble with leaking valves, etc. We find that the engine is very easily maintained and kept up. We run two engines in parallel every day and have no trouble whatever with parallel operations. Gas for the past six months has cost an average of 4.65 per k. w. hour. If I have not given the information that you desire I will be glad to answer further questions.

F. D. Elwell (Sidney): I have taken somewhat of an interest in internal combustion engines, and took occasion to visit a plant that has identically the same equipment as the one referred to at Bellefontaine. I had heard pretty good reports concerning its economy, etc., but upon getting a look into their store-room I saw they had enough repair parts lying about to nearly make an engine. In the case of Bellefontaine they have a Diesel oil engine man in charge. There is no doubt about it that he is an expert. I would like to ask the brother if he has had any trouble with needle valves sticking in his oil engine?

S. E. Folk (Bryan): Not a bit. When the engines were first installed there were a few admission valve springs broken, and the engineer in charge made a report to the New York office, which sent springs of larger diameter. Since the smaller springs have been replaced with springs of larger diameter we have not had a single spring broken. Everything has been satisfactory up to the present time, and for the past year we are more than well pleased.

B. H. Gardner (Dayton): Do you have any trouble with your voltage regulation under fluctuating load; is your load very fluctuating?

S. E. Folk (Bryan): None at all. We have one 50 horsepower motor; three 5 horsepower motors, two 3 horsepower motors, and a number of smaller ones. We also have on the engine the city water pump operated with electric motor. We are using Worthington turbine pump direct connected to electric motor. We have had no trouble during the day with variation whatever. The engines take care of that nicely. I believe that Mr. Hubbell is here and can speak as to our plant. He has been there. The record of the recording voltmeter will show that the regulation has been within one per cent.

H. O. Dutter (Bryan): I would like to ask if you have an automatic regulator upon your machine? You do not depend upon your engine to give you regulation?

S. E. Folk (Bryan): We keep the regulation so accurate with an automatic regulator that it is within one per cent.

H. O. Dutter (Bucyrus): Would you have good regulation if you did not have your current regulated, whether you have automatic, or whether you have engine regulation itself simply?

C. M. Lott (Hicksville): I can vouch for the accuracy of Mr. Folk's statements. He made the statement that the running expense per k. w. hour

covering amount for sinking fund to pay bonds, interest, etc., was 4.65 per k. w. hour. I would like to inquire for how long a time the bonds are to run?

S. E. Folk (Bryan): Bonds to the amount of \$60,000 were sold for the installation of this plant. We set aside \$500 a month, which will pay the face of the bonds in ten years, and \$250 a month for interest; so that we expect to pay for the plant in ten years. The capacity of the plant is 300 k. w. The output varies from 900 to 1500 k. w. hours a day, varying with the demand for motor load. The power factor during the day is 70 per cent.

C. C. Custer (Piqua): I think that the advantages of the gas engine are often overestimated, for the reason that the chief talking point is the low fuel cost. We have been told today that some of these engines produce a k. w. at the switch-board for as low as .25 to .40 cents per k. w.; but taking the disadvantages of the gas engine, although of course we hear of cases where they do not have any trouble with shut-downs, but we all know from our experience with other gas engine plants that they very often have to shut-down very unexpectedly. If a gas engine goes wrong it occurs so suddenly that you do not have a chance to change over to a spare unit. If you can get a good gas engine—it is no use to get a poor one—I believe the cost of a gas engine is at least one and a half times the cost of a steam engine, and it may even approximate what the cost of the whole steam plant would be. If you have a compound condensing engine it is not any trouble to get a fuel economy of 7-10 cents per k. w. hour when the plant runs 24 hours a day in a town of the same size as Bellefontaine. I know of a plant which runs 24 hours a day where sometimes the load factor is very poor, and still the fuel the year around will not average more than 7-10 cents per k. w. hour. If you have only 4-10 cents per k. w. hour as compared with 3-10 cents per k. w. hour for steam engine, you are only saving 3-10 cents per k. w. hour, and I know that this plant that I speak of is more reliable than any gas engine that can be made, and this reliability ought to outweigh a difference of just a few cents per k. w. hour. Of course the fuel consumption is not the only consideration with an electric light company. Take this steam plant that I spoke of where the fuel only costs 7-10 cents per k. w. hour and the other station charges approximate about 2½ cents per k. w. hour, and when you add in the distribution charges and interest on investment, the total cost per k. w. hour delivered to consumers would be about 3½ cents. I believe the gentleman said, that counting depreciation and interest on investment he figures that they have been able to get something like a current cost of 4½ cents per k. w. hour. I think there are a great many steam plants that can beat that considerably, towns as small as Bryan. I think if there was so much in the gas or Diesel engine you would find that more of the larger towns, such as Dayton would have them. You find that all the larger plants in the larger towns are strictly steam engine plants. I think that the gas engine has been over-rated, particularly on account of its liability to get out of fix and the amount of repairs necessary to keep it in order; also because there are plenty of things that happen to a gas engine that even the best engineer can not foretell. I think

the chances of shut-down are very much greater. Although we hear of a very few gas engines that give reliable service, I think all of us can refer to some gas engine plant in our own neighborhood that is giving very poor service.

F. D. Elwell (Sidney): As an operator of gas engines I would say that we have very little trouble, but we have had some. When I went to inspect this oil engine plant that I referred to I took one of my engineers along and told him to keep his eyes open. When he came back he said that the principal thing that he had learned was that they were as big liars as we were (Laughter.) Regarding the first cost of the Diesel oil engine, I believe that a 250 horsepower Diesel oil engine up to a year or so ago was priced at \$14,500. I understood they have since then raised that \$1,000. A first class gas engine of 280 horsepower, or 300 horsepower, of either the Westinghouse, Koerting, or any other of the best makes, will cost about \$6,000, and a first class compound steam engine will probably, as you all know, run from \$1,800 to \$2,500 less than the gas engine.

W. M. Adams (Elyria): Gentlemen, I would say as to reliability that I used to crack up the steam engine as against the gas engine; but after four years' experience with gas engines I can not see but what they are as good or better than steam engines as far as reliability is concerned. One gentleman said that he could generate current for 7-10 cents fuel cost per k. w. hour; how much for attendants?

C. C. Custer (Piqua): I think we have two men on a shift, four in all, one in the engine room and one in the boiler room.

W. M. Adams (Elyria): The gentleman also mentioned that there were no large gas engine plants in the country. I think that at San Francisco, Calif., they have five 5,000 horsepower units, manufactured by the Snow people. We have six 1,000 horsepower units, and we have one 1,000 horsepower steam unit, and we have never operated that steam unit any more than we could help.

Prof. F. C. Caldwell (Ohio State University): Mr. President, there is one characteristic of human nature that I think comes in in this question of the repairs to the gas engine, troubles with gas engines, etc., and that is that where a thing runs smoothly and does not make any trouble we do not hear anything about it. When it gets into trouble we do. It seems to me that the great difficulty with this question of the life and repairs of the gas engine is that we are dealing with hearsay evidence largely in individual cases: we lack anything in the way of authoritative statistics. If there was any way by which statistics could be obtained from different users of gas engines in regard to what their experience has been it would be very much more valuable.

S. E. Folk (Bryan): We all know that there are always a lot of leaky valves in steam engines. That is one thing that increases the cost of maintenance. The gas engine with the same care will give equally as good satisfaction as to reliability. In the Diesel engine we have no gas producers, simply the engine itself. We get oil delivered at \$2.95 per 100 gallons at the plant for the Diesel engines. You have to keep them in order or they will not run for you. If a man is negligent and feels that the engine will run along somehow

and he will fix it tomorrow, etc., he will get into trouble. To secure the best results the engine must be maintained and taken care of properly. I do not believe that there is any steam engine of 300 k. w. capacity that can compete in fuel expense with a Diesel engine of like capacity. What makes our k. w. cost high is the interest and sinking fund to pay off the principal. The cost of labor up to the present time, repairs, fuel, lubricating oil, etc., is small. It cuts down labor expense; we save the labor of two men in the plant. I do not believe that any internal combustion engine will give satisfaction if it is neglected.

Ex-Prest. Engel: Have you had any trouble at all with difference in gravity of the oil?

S. E. Folk (Bryan): None at the present time.

Ex-Prest. Engel: Do you test it so as to know whether you are always getting about the same gravity?

S. E. Folk (Bryan): We have made no test whatever. The contract requires the company to furnish oil of less than one-half per cent sulphur and one-half per cent water. We have had no trouble whatever with the oil.

E. T. Selig (Mt. Vernon): We have plants of some 15,000 to 20,000 horsepower in our county pumping gas, some of which have run three or four years. I was talking with the chief engineer of one of those plants the other day. Three years ago he was glad to work for us at \$50.00 a month. He is now the head of one of the plants of I think about 12,000 horsepower all Snow engines. He says they do not take a great deal of care and that they have had no unusual difficulties at all with them. In one plant they have a 5,000 horsepower steam pump; but that was put in because they took it from another field, not by reason of their wanting extra reliability.

W. M. Adams (Elyria): The greatest trouble we have had in gas engine operation has been from steam engineers. I would not have a steam engineer run a gas engine for me, because 90 per cent of the steam engineers have no use for the gas engine. There is another thing that you do not have to have in a gas engine, and that is you do not run against the license proposition. In our country they have a union, and if you do not have a licensed man and his card on the wall you can not have him, although the licensed man may not be worth the price of the card. We make a rule to examine our igniters once a day. We use nothing but a common piece of Nicoly wire. We do not use platinum. I think we pay 5 cents apiece for them. When they get too short we pry them out. We keep a set of extra igniters handy so that we are always prepared to put in new ones.

F. B. Carr (Cleveland): I have never had the pleasure of meeting Mr. Adams. I have been thinking of buying a gas engine, and I quietly slipped down to his plant and went in and got acquainted with the engineers, who I found were as enthusiastic on the subject as he is. I found that they could not say too much for the operation of their gas engine. He said they had very little trouble, in fact had not shut down for a year or more. I think one of

them was an ex-steam engine man who said he would not have a steam engine where he could get a gas engine to do the same work.

W. M. Adams (Elyria): A year ago last April we had a slight shut-down for a few minutes, and have never had another one since. We made repairs 'n the building and had to cover up the machine.

Ex-Prest. Engel: This discussion is surely good for what ails us, gentlemen. I would say that if any of you have any further questions upon any of the papers that have been or will be offered during the convention that a special number on the program has been reserved in which to bring up any such questions. If you will call the attention of the chair to it we will be glad to have them brought up and discussed. If there are any who feel that they want to ask further questions now, we will give them the opportunity before we adjourn this session. It is now 4:25 p. m.

B. H. Gardner (Dayton): In competing with gas salesmen we often run against the statement that they make to prospective customers that anybody can run a gas engine, that a gas engine does not need any attention. I would like to ask Mr. Adams whether he agrees with any such statement as that?

W. M. Adams (Elyria): That is one great mistake they make. Salesmen come around and tell those things, but that is not the fact. I have tried to interest steam engineers in this subject and have told them in individual cases that the time was coming for them to take hold of the gas engine and that they should make themselves as familiar with it as with the steam engine. I gave one such steam engineer a job, and he tried it about a month, and then got disgusted. Another mistake that salesmen make in selling gas engines is to sell a man a large unit when perhaps they ought rather to have sold him two smaller ones. So far as reliability goes I think the gas engine is superior. There is no blowing out of flues, for instance.

E. A. Bechstein (Sandusky): What do you know about the life of the oil engine? The gentleman who said that his plant would be paid for in ten years. I would like to ask him what the plant will be good for at the end of the ten years, and where the dividends are to come from?

S. E. Folk (Bryan): Our people figure that in ten years it will pay for itself. The village has not been taxed anything for payment of the bonds, and if the plant pays for itself in ten years then they consider that they have got it without being taxed to pay for it. Of course if we had a private company we would be obliged to set aside a dividend.

E. G. Garber (Belleville): I might say that I have been investigating gas engine property myself. I came around by way of Jefferson. I understood they had a gas engine in use there. It is a medium sized plant, and they have two engines that have been in use six years. They say the cylinder head had not been off in four years. They have never had any trouble with shut-downs. The only shut-down they have had was caused by trouble with the ignition. Their battery did not hold out.

After some announcements as to entertainment features, etc., by Mr. M. E. Turner, chairman of the Committee on Entertainment, the convention adjourned to 9:30 a. m. August 26th.

SECOND SESSION—WEDNESDAY MORNING, AUGUST 26.

The convention met pursuant to adjournment, President Tait in the chair; Secretary Gaskill at his post.

President Tait: Gentlemen, before proceeding to business this morning I would like to state that I am sorry I was not here yesterday at the starting. It was only by a great deal of hard travel that I was able to be here last night. Am very glad to be with you this morning. I found that one of the things which was not done was the reading of my address, which I left here. So with your permission I will read that now.

PRESIDENT'S ADDRESS.

By F. M. Tait, Dayton Lighting Co., Dayton, O.

To the Members of The Ohio Electric Light Association:

This is the Fourteenth Annual Convention of your Association, and I note from the records that the Association has met here several times previously.

Looking over the past year, since our last convention at Toledo, Ohio, we must all be impressed with the rapid growth of the electric light and power interests in this state, and in the United States.

We have gone through a period of severe business depression, and while many companies suffered, the great majority have held their own, and profited in many ways, from the hard experience.

There has been a decided tendency during the past year for competitive electric companies in the same territory to consolidate, thereby effecting what is absolutely necessary for complete business and financial success in a public service utility of any sort. It is only by the complete and absolute control of the electrical output in any community that a public service corporation can lower its production and distributed costs, and thereby benefit the consumer as well as help the company.

But monopoly does not and cannot successfully mean disregard for the public rights and welfare, and I believe that any lighting company's responsibility increases in proportion to its complete and absolute monopoly of the lighting situation in its territory.

The workings of the state commissions on public utilities in several states has been going on for some time, and the opinion is gaining that competent commissions with proper and just laws to work under will eventually prove to be a good thing for the legitimate and honest electric company.

Several prominent bond houses have recently stated that certain bonds offered for sale were considered to be good, because among other desirable features, the electric company was working under a competent commission, insuring safety and a square deal to the electric company and its interests.

The municipal ownership idea seems to be gradually falling behind, and properly too, because each year is bringing the tax-payer to a better realization of the fact that "the public pays the bills."

Data collected by our secretary from the municipal plants in Ohio proves that the average municipal plant is far behind the same type of private plant similarly located. I believe it is only a question of a few years more that the municipal plant will be a rare exception, and not nearly so general as at present.

We have a splendid paper on "Why Municipal Plants Fail," to be read at this convention; and I know you will all derive great good from it.

I have had occasion to learn that many of our central stations do not keep proper books, and do not have correct records of their costs. This is all wrong, and must be corrected before those plants can hope to make a success of their operations.

It has been learned that many of our smaller central stations in Ohio feel that the expense of joining this Association and coming to the convention each year is not justified. I feel gratified to know that many of these plants have been brought to a realizing sense of their need of the co-operation and help of our Association, and have come in with us.

This work should go on until nearly every central station in Ohio is represented on the Association's roll.

We must all feel gratified at the continually expanding field for the further and new uses of electric current constantly being developed. The latest scheme in this direction is the new "Electric Light Trap," used to catch certain kinds of destructive moths at night. Powerful electric search lights with electric exhaust fans accomplish this purpose, and the central station sells the current.

We are all elated with the arrival of the high efficiency lamp units consuming one and one-quarter watts per candle, and promising even better efficiency than this in the near future. We are soon to have the 20 candle power 25 watt Tungsten lamp, mounted in the same size bulb as our present 16 candle power carbon filament lamp.

All this, with better to follow, surely makes our outlook for increasing and profitable business very bright.

The papers to be read at this convention have all been selected on timely subjects, and you will note that the papers, with few exceptions, are short. This was purposely done that plenty of time could be given up to questions and discussions. I hope that every one present will consider it his business and duty to obtain all the information and good that he can out of each of our

meetings. That is what we are here for, and I hope there will be a full and free discussion of all the papers.

If you have any central station troubles or difficulties and want help, let us try to help you. That is what the Association is for.

You will note on our program several committees whose sole business is to bring together those who are not acquainted; others, to furnish entertainment; and others, again, to see that you are properly amused.

I hope you will all have a good time at this convention, and go home and back to business feeling that your visit here with us has been highly profitable and entirely satisfactory.

I cannot refrain, in closing, from calling the attention of our members to the heavy burden that our genial secretary, Mr. Gaskill, carries each year in the way of work to keep the Association and its interests going properly; and I know that the success of the Ohio Electric Light Association to date is very largely due to his tireless activity for its welfare and the welfare of all its members.

Secretary Gaskill: Mr. President, there is another Association meeting at this hotel, the Astronomical and Astrophysical Society of America. Some of the gentlemen in attendance upon it are of world-wide fame as astronomers. In view of the fact that this Association deals with technical questions as well as they, I think it would be a very nice act of courtesy if the Ohio Electric Light Association would extend to the Astronomical and Astrophysical Society of America the courtesies of the Association, and that they be invited to attend our sessions and entertainment whenever they find it convenient.

The motion was seconded, and carried unanimously.

President Tait: Pursuant to that resolution I will appoint Messrs. T. D. Buckwell and L. Clifford Anderson to personally present our compliments to Prof. E. C. Pickering, president of the Astronomical and Astrophysical Society, and to communicate to that Society through him the action we have just taken. If the committee will see that that is done I will appreciate it. I believe that the A. & A. Society is at this time holding a session at the other end of the building. Prof. Pickering is the director of the Harvard College Observatory, and both he and the other members of the Society are very eminent astronomers.

The Secretary has some matters that he wishes to bring before the Association.

Secretary Gaskill: Gentlemen of the convention, I have suggested to the President that the financial report of the Secretary be presented at this time, and then lay over until tomorrow for action, in order to give opportunity to any of you who may have a criticism to offer to register it before action is taken on the report, which is as follows:

Secretary-Treasurer's Report.

Secretary and Treasurer's report for year ending August 20, 1908:

To the members of the Ohio Electric Light Association:

I have the honor to submit to you my report of the finances of the Association for the year ending August 20, 1908:

balance on hand at end of Association year, August 17, 1907.....	\$ 201.55
Received from sale of buttons, Convention 1907.....	112.50
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Received from sale of Advertising in Souvenir Program.....	404.51
Dues from associate members.....	600.00
Dues from active members	495.00
Sale of proceedings.....	1.50
	<hr/>
	\$1,815.56

Disbursements.

Sundry expenses at 1907 convention.....	\$ 50.76
Boat ride 1907 convention, including music and guards.....	230.50
Toledo beach dinner.....	84.00
Reporter for 1907 convention.....	79.25
Badges for 1908 convention.....	86.78
Salary of secretary.....	350.00
Printing and publishing.....	477.75
Postage	83.50
Traveling expenses.....	121.60
Telephone, telegraph, express and freight....	13.50
	<hr/>
	\$1,577.64
Balance on hand.....	237.92
	<hr/>
	\$1,815.56

The past year has been the most successful one in the history of the Association. The work has been very active throughout the year.

In addition to the regular work, there was published the lighting rates of Ohio, both private and municipal, a work that has been met with great favor by the stations.

The Souvenir Program was again issued the profits of which will net the Association about \$450.00.

I would recommend that the Association publish its own program in the future instead of letting it out by contract as heretofore. The profits will be greater and better satisfaction obtained, both by the advertisers and the officers. I wish to express my great appreciation of the valuable services of Mr. F. M. Tait, our excellent president, in assisting the secretary in his work

and in building up the membership of the Association. I also wish to express my thanks for the uniform courtesy and assistance of all the members, both active and associative in the work of the year.

Respectfully submitted,

D. L. GASKILL,

Secretary and Treasurer.

Secretary Gaskill: I would state that a copy of the financial portion of this report is in the hands of the Executive and Finance Committees, and the books have been audited this morning, all of which will properly come up in the proceedings later for action. The report is read at this time in order that the membership may have opportunity to know the financial transactions and make any suggestions they desire before final action is taken.

I may state that we have a large number of applications for membership, which have been endorsed and are in the hands of the Executive Committee. Just as soon as the Executive Committee reports upon that list it will come before the convention for action. I am happy to state that the additions to our membership this year are more numerous than they have ever been. There are 11 applications from central stations and some 18 from associate members. There are a few who are in attendance who are not yet members of the Association, and it is urged upon these gentlemen by the officers that before you leave the Bay we would be glad to have you leave your applications for either active or associate membership, whichever fits your case. We are trying hard to build up the Association. It is now the largest in the United States of the State Associations, and we want to make it twice as large.

President Tait: Mr. F. H. Plalce's paper happens to be the first one on the program for this morning's business. Mr. Plalce is not here. I do not know whether he expects to be present this morning or not; but in order to give him the opportunity to read his own paper I have deemed it wise to change the program a little, and we have asked Mr. C. R. McKay, of the Toledo Railways & Light Co., to read his paper now, entitled "Experience With Luminous Arc Lamps."

— 2 —

Experience With Series Luminous Arc Lamps

By C. R. McKAY, Toledo Ry. & Light Company, Toledo, Ohio.

This paper is intended to give in brief form the essential facts concerning a recent large installation of luminous arc street lighting.

In February, 1907, "The Toledo Railways & Light Company" started in regular service some 547 luminous arc lamps of the General Electric type for series street lighting. This number has been steadily increased, until at the present time about 1670 of these lamps are in regular service.

The first few hundred lamps were operated from belt driven brush arc generators, which machines were gradually removed as the installation of 25 cycle constant current transformers with mercury arc rectifiers and switch board panels progressed.

All the street lighting in Toledo is now effected by means of such lamps, which for the most part are spaced approximately 600 feet apart in the residence and out-lying districts of the city, while in special cases, such as the display illumination of Summit street, the lamps are concentrated there being throughout the shopping district on this street, ornamental iron poles, each carrying two lamps and spaced approximately 80 feet apart, opposite to each other on each side of the street.

STATION EQUIPMENT

The required energy is generated in 3-phase Curtis turbo-generators wound for 4000 Volts connected.

Thirty-seven constant current 25 cycle 50 light transformers, wound for 2200 volts primary, were installed, together with a corresponding number of mercury arc rectifiers and switchboard panels. [See cuts 0 and 1.]

Thirty-four of these rectifiers are of the air cooled type, the blast being supplied by either of two fans, driven by 12 h. p. 25 cycle induction motors, each of which has ample capacity for the entire 34 sets.

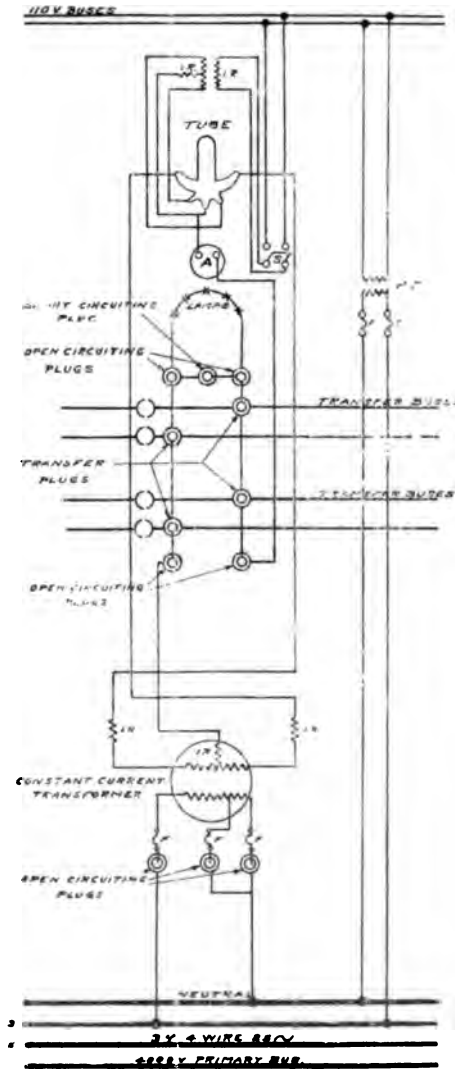
Three sets with oil cooled rectifiers have since been added to the original installation.

Six of the air cooled transformers and rectifier sets are installed in a substation in East Toledo, to which current is transmitted by submarine cable under the Maumee River.

The entire operation of this substation at the Starr Ave. Car Barns is conducted by a car dispatcher without interfering with his ordinary duties.

Each circuit panel supports one rectifier, with adjustable blast gate, ammeter; excitation switch, primary secondary, and short circuiting plugs, but transfer plugs and tube tilting handle. [See cut No. 2.]

Cut No. 2.



SWITCHBOARD WIRING
MERCURY ARC PANEL

CUT No. 0.



Switch Board with Mercury Arc Rectifiers, (day photo)

CUT No. 1.



Switch Board with Mercury Arc Rectifiers. (night photo)

In the generating station a totalizing panel located in the center of the arc switchboard supports three indicating wattmeters, three recording wattmeters and two triple pole, double throw fused switches, each of these switches controlling a blower motor.

A three phase 4-wire 4000 volt bus, controlled by a motor operated oil switch, traverses the entire length of the arc switch board behind the sub-bases. The transformers are so connected between the neutral and outer buses as to closely balance the system.

The transformers stand in two parallel rows on the engine room floor directly below the switch board gallery, and their primary and secondary leads rise directly from the transformers terminals to the rear of the panels overhead.

In case of necessity, it is possible to supply power for the luminous arc lights by inverting either of two 1000 k. w., 25 cycle rotary converters, normally used to convert alternating current into direct current for operating the street railway.

These two machines, together with a synchronous motor generator set, are also utilized when desirable, to compensate by strengthening their fields, the lagging current taken from the generators by the rectifier sets.

LINES

All lines leave the power house in multiple conductor lead covered cables with 7-32" paper insulation on each conductor. After traversing the underground district in vitrified tile, or cement lined iron duct, the circuits continue overhead on ordinary construction with double petticoat glass insulators.

No unusual line troubles have occurred either on the aerial, underground, or submarine lines, although surges, co-incident with tube flashing, have occasionally punctured temporary wiring between transformer secondaries and rectifiers.

The lamps are generally hung over the center of the street intersections, at a height of approximately 25 ft., by means of suspension wires, and are lowered for trimming.

The first lamps were started during stormy winter weather, and some difficulties were encountered due to high winds rupturing the arcs.

The light in this type of lamp issues chiefly from the arc itself, instead of the positive crater, and being much longer than the carbon arc the magnetite is quite sensitive to rupture by air draughts, unless thoroughly protected by windproof casing and globe fit.

Originally, upper electrodes of $\frac{3}{4}$ " diameter were in use, but these tended to oxidize, thus reducing the diameter and resulting in sticking or welding of electrodes.

These difficulties have been satisfactorily remedied in the latter type of lamps by securing wind proof contact between globes and canopies, and by the use of upper electrodes of large diameter copper, surrounded by a sheet iron sleeve.

The life of the lower electrode has been increased from approximately 110 hours to over 160 hours, and it is expected that the upper electrode will last fully a year.

The luminous arc lamps in operation average from 320 to 324 watts per lamp, including line losses, as measured at the direct current circuit terminals. The watts at the circuit terminals for the alternating current $7\frac{1}{2}$ ampere lamp averaged 525, showing an approximate reduction of 38 per cent. in energy per light supplied to the circuit.

The present 1670 lamps, distributed over 37 circuits are trimmed by three trimmers, each provided with horse and buggy, and about 1 per cent. of the lamps are in the shop as an average, for adjustment or minor repairs.

Gazing directly at the luminous arc, there is discernible to the trained eye a slight frequency flicker, which is imperceptible in the general illumination.

It is possible in residence streets lined with trees and hence lacking reflecting walls, to read ordinary newspaper print at night midway between lamps spaced 550 to 600 ft. apart.

The satisfaction afforded by the illumination from the new light is well illustrated by an incident of the Maumee River flood of Feb. 1908, when it became necessary to substitute without notice the original $7\frac{1}{2}$ ampere enclosed alternating current lamps in place of the luminous arc lamps, owing to the breakage by a falling bridge span of six arc circuits supplying some 300 lamps in East Toledo, prior to equipping the above mentioned substation.

Vigorous protests to the city council from residents and merchants of East Toledo clearly expressed the public opinion as to which type of lamp gives the best illumination.

EFFICIENCY AND POWER FACTOR

At the last annual meeting of this Association, held in Toledo during August 1907, data was requested as to the efficiency and power factor of the system in actual practical operation.

Conditions at that time did not permit the running of accurate tests, although approximate figures were available which have since been verified by more detailed tests, carefully conducted with the object of checking the manufacturers' guarantees, which have been closely confirmed.

The following tables show, under different conditions of load and transformer connections, the input and output figures, together with the resulting power factors and efficiencies:

TRANSFORMER ON 100 PER CENT TAP.

- LOAD -		- A. C. INPUT-25 CYCLE -					- D. C. OUTPUT -				
	Lamps	% full load	Amp.	Volts	K. V. A.	K. W.	per cent P. F.	Amp.	Volts	K. W.	% Effic'y
a	50	100	13.74	2308	31.70	17.55	55.4	4.04	3869	15.75	80.8
b	37	74	13.70	2308	31.55	14.17	45.0	4.13	2892	11.94	84.3

TRANSFORMER ON 80 PER CENT TAP

- LOAD -		- A. C. INPUT-25 CYCLE -					- D. C. OUTPUT -				
	Lamps	% full load	Amp.	Volts	K. V. A.	K. W.	per cent P. F.	Amp.	Volts	K. W.	% Effic'y
c	37	92.5	10.01	2204	22.06	13.50	50.3	4.17	2877	12.00	88.4
d	25	62.5	9.20	2205	21.13	10.09	47.1	4.12	1952	8.04	79.7

	A	B	C	D
Volts per lamp D. C. (line losses included).....	80.0	78.2	77.8	78.1
Watts per lamp D. C. " " "	315.0	323.0	324.0	321.0
Watts per lamp A. C. " " "	351.0	333.0	307.0	403.0

The efficiency indicated above is the ratio of D. C. output to the circuit to the A. C. input to the constant current transformer, and includes all losses in the transformers, reactances, rectifier, and switchboard wiring and connections. All instruments were calibrated before and after the tests.

The efficiency and power factor readings are in each case averages of ten separate tests, which showed practically no variation from each other.

The primary A. C. voltage during the test was about 5 per cent. above rated transformer voltage, which fact may account for the low power factor.

During each test the circuits were patroled to insure that the full number of lamps specified were actually burning.

The values of the A. C. input to the transformer under test were closely confirmed by both the indicating and the recording wattmeters on the totalizing panel, which gave averages for the entire installation; therefore these values are not open to criticism as representing special conditions unattainable in normal operation.

POWER FOR AIR BLAST

The following figures show the input to the blower motor with various numbers of blast gates opened:

POWER FOR AIR BLAST. [BLOWER MOTOR INPUT.]

No. Blast-Ports Open	K. W. Input	Average kw. per blast
0 (Fan running light)	3.37	0.
10 (Fan running light)	4.65	0.47
20 (Fan running light)	6.08	0.30
31 (Fan running light)	6.48	0.21

An important factor in the life and operation of mercury rectifier tubes is the temperature range to which they are subjected, and unsatisfactory results from tubes of moderate voltage could perhaps frequently be attributed to improper temperature conditions. The blast temperature can not readily be regulated in all seasons and localities, and therein may lie a strong inherent advantage of the oil cooled type over the air blast type.

MERCURY RECTIFIERS

Until recently little if any data has been available with regard to the life of the rectifier tubes used in this system of street lighting.

In the installation described in this paper, an exact and continuous record is kept of the life and performance of each tube.

The manufacturers guarantee an average life for all tubes of 400 hours operation.

The figures given below illustrate the average tube performance, up to June 1st, 1908, besides in addition, showing the number of in-operative tubes received, the number of tubes received in operative condition but lasting less than the guaranteed period, and the number of tubes exceeding the guaranteed period, together with their average life.

RECTIFIER TUBE MORTALITY STATEMENT.

JUNE 1st, 1908.

	Life 0	In 1400	Hours 5400	Totals
No. Tubes.....	6	45	44	95
Total Hours.....	0	3993	63110	66993
Average per Tube.....	0	82	1430	704
—† Minus. * Plus.				

The fore-going record includes both oil cooled and air cooled tubes, but further experience with the oil cooled tube is desirable in order to definitely establish a preference. There are, however, reasons for expecting greater life from the oil cooled than from the air cooled tubes.

There are many tubes in operation in this installation which have exceeded 2000 hours life, and several have exceeded 3000 hours life. The maximum recorded life of any tube up to June 1st, 1908, was 3589 hours and 8 minutes.

The average life of 23 tubes which burned out during May, was 1110 hours. Five of this number were in-operative when received.

The average life of the remaining 18 was 1476 hours.

47

CUT No. 3.



With Luminous Arcs Display Lighting, Summit Street,
Toledo, Ohio, (night photo)

DISPLAY STREET LIGHTING

A strong demand has arisen among the merchants of Toledo for an extension of the display street lighting put into effect on Summit street.

[See cut No. 3.]

This is an excellent illustration of the commercial value of light in attracting valuable business from the dark and unattractive streets.

One half of the cost of the Summit street illumination is paid to the city by the property owners and merchants benefited thereby, and on several other streets the merchants, finding their trade shifting to Summit street stores, have united in petition, which have been approved by the city council, to extend the same scheme of lighting to include their localities.

The Summit street installation was carried out on the high tension series system, with expensive underground construction and heavy ornamental iron poles. Consequently the total investment per lamp was unduly high, involving the future carrying of high fixed charges, notwithstanding the contract rate per lamp is the same as for lamps in the overhead district.

Reliable luminous arc lamps for multiple operation across 125 volt circuits, or two in series, on three wire 250 volt circuit are available.

The installation of such lamps in congested districts where 3-wire direct current underground mains exist, can frequently be carried out at an additional cost of but 50 to 65 per cent of that required with the series system, and although the multiple lamp will draw on the station for about 30 per cent additional power, the saving in fixed charges will generally far more than offset the additional power cost throughout the life of the lamp.

CONCLUSION

The luminous arc light system operated from constant current transformers and mercury rectifiers is a commercial success, possesses high efficiency, is economical of power, is reliable in operation, is economical in maintenance and insures a more satisfactory natural distribution of light for street illumination than either the open or enclosed carbon arc light systems.

6mc

Referring to the statement made in the paragraph just preceding the concluding paragraph of the foregoing paper, Mr. McKay remarked that that only applied to the particular conditions there mentioned, and that it would not be advisable to undertake to use multiple arc lamps in a general distribution system of street lighting where you have a wide field to cover.

Discussion.

President Tait: The paper of Mr. McKay is now open for discussion. I know that everybody is interested in high efficiency arc lamps. I hope if there is anything about the paper, or about the luminous type of arc lamp or any other type of arc lamp that you want information on, that we will hear from you now. Let us have a free and full discussion of this matter.

F. D. Glosser (Marion): I would like to ask if these lamps and tubes for them operate directly on 25-cycle circuits without the use of frequency changers?

C. R. McKay (Toledo): There are no frequency changers used in the operation of these lamps. The 25-cycle current from the turbines is supplied to the constant current transformers and delivered by them at the same frequency to the rectifier tubes which in turn change that 25-cycle current to a pulsating direct current.

President Tait: Generally speaking, what is the difference in efficiency between the operation of those lamps on tubes as compared to operating them on motor generator sets, approximately?

C. R. McKay (Toledo): I do not think that I can give you any accurate figures on that because it is largely a matter to be worked out in a given installation, but probably a motor generator set such as would be ordinarily used would not exceed the capacity of 100 lights per circuit, and on account of the low energy per lamp taken by this class of lamp I doubt whether any motor generator set would show up an efficiency much better than 85 per cent or 86 per cent at its full load; whereas the efficiency obtained by the rectifier system as indicated by the tests given is considerably higher than that; furthermore it is to be borne in mind that by the use of constant current transformer you are dispensing with any additional running machinery other than the generator itself. The attendance required in the operation of constant current transformers with rectifiers is very little indeed. We have in this station some 34 sets approximately, and the work of handling that board is done by exactly the same attendants who look after the other switchboard work in that station, which is a station of some 15,000 k. w. capacity in the various systems. Practically none of their time is spent on the rectifier board except when they are plugging in circuits. If a tube goes out during the course of operation the men will easily observe it from any point in the power house because when the rectifier switchboard is in operation each of the rectifier tubes on the face of the board is relatively illuminated with the peculiar bluish-green light of the mercury arc, and if any of the tubes go out it is easily perceptible from any point in the station by simply looking at the

board. The tube can be replaced in a couple of minutes with new tube, in case it goes out.

President Tait: Is there any further discussion?

S. F. Messer (Warren): I would like to ask about replacing tubes in the oil-cooled type, as to the length of time required?

C. R. McKay (Toledo): The length of time required to replace a tube in the oil-cooled type is very little if any longer than in the air-cooled type; but with the oil-cooled type you do not see the tube in operation, and the only way that you know when it is out is by looking at the ammeter.

President Tait: I notice a statement in your paper, Mr. McKay, to the effect that "one-half of the cost of the Summit street illumination is paid to the city by the property-owners and merchants benefitted thereby, etc." Do those merchants and property owners make a contract with the city for a definite length of time, and how does the city assure its getting paid for it? If it is not paid, what arrangement have you to deprive the one who does not pay for it from the use of the light along that street? I have had a good deal of trouble along similar lines, and would like to know how you meet that.

C. R. McKay (Toledo): The contract of our company is directly with the city. We get our orders from the city to erect these lines. We deal only with the city in connection therewith. So far as I am aware no case has yet arisen in Toledo where the city has had any difficulty of that nature; so that what they would do in the event of a dispute of that sort I do not know; but I think the matter would simply assume this form, that in the first place these display installations having been made at the direct request and on petition of the property owners along the street, these petitions bearing their signatures. If the city concludes to go ahead with it they simply figure up the cost per front foot, and then they levy a tax on that entire portion of the street which is benefitted by this improvement, and would proceed to collect that tax just as they would any other city tax. I do not think there has been any occasion for them to have to resort to legal procedure of any kind as yet. In fact, they have had some difficulty in holding down the demands on it.

President Tait: Mr. Grabill, of Ashland, O., read a paper at a former convention on luminous arc lamps of a similar type. Has he anything to offer on the luminous arc lamp this year?

H. P. Grabill (Ashland): Nothing, except that we are very well satisfied with our lamps, and in comparison with the ones at Toledo we are getting 180 to 190 hours of operating, with lower electrode. Our average outage per light per month on midnight moonlight schedule is $1\frac{1}{4}$ hours, and during the month of August up to the time I left we had not had a lamp out, and are very well satisfied with our system.

President Tait: Mr. Grabill operates his arc lamps, as I understand it, on 4-ampere Brush arc machines belted and riveted, so that you get both sides of the story today in that way.

F. D. Elwell (Sidney): I would like to ask if the rectifier system is as

subject to ground troubles as the Brush arc lamp, and if the tubes are liable to rupture in case the lamp becomes grounded.

C. R. McKay (Toledo): We have not noticed any particular liability to grounds with our system, or any perceptible effect on the tube life as the result of grounds. Our circuits become grounded, of course, as all other arc circuits do; but we test all our circuits several times a day, and as soon as we find one that is grounded we get to work and try to clear that up. I might say that ten days or two weeks ago we had a very severe storm that passed over Toledo during the night, and while we had a great deal of trouble as a result thereof on our a. c. incandescent distribution, we did not have a single circuit out on our arc system that night.

F. D. Glosser (Marion): I would like to ask if the tubes and constant current transformers affect the line in any way by severe voltage fluctuation such as we have on an interurban railroad 25 mile transmission line?

C. R. McKay (Toledo): We have not had any severe voltage fluctuations on our system such as would enable me to pass an opinion on that from experience; but I should say that any reasonable fluctuation perhaps within a range of 10 per cent either side of normal would not probably affect the tubes perceptibly, because there is a certain amount of regulation affect the tubes perceptibly, because there is a certain amount of regulation in the constant current transformer and it has also a high reactance, unless it should so happen that the transformer was operating up to full load, in which case it would perhaps not be able to take care of a severe drop of voltage, but I think under almost any ordinary conditions it would stand a pretty fair range in voltage fluctuation.

President Tait: Is there any further discussion? If not, we will proceed to the next paper, which is entitled, "Best Ways and Means of Getting Out and Keeping Out Private Plants in Central Station Territory." This will be presented by Mr. B. H. Gardner, of the Dayton Lighting Co.

BEST WAYS AND MEANS OF GETTING OUT AND KEEPING OUT PRIVATE PLANTS IN CENTRAL STATION TERRITORY.

By B. H. GARDNER, Dayton Lighting Co., Dayton, Ohio.

Before attempting to prescribe for a patient the doctor must first diagnose that patient's malady; and so before considering the question of how best to get private plants out of central station territory, we should ask ourselves why we have these plants.

There are two parties to be blamed—the central station and the party who puts in the plant. In law, the prisoner at the bar is adjudged innocent until proven guilty, but for that central station whose territory is filled with private plants a verdict of guilty may be safely returned without a hearing. I do not mean by this that it is always possible to keep out all private plants, for as long as human nature remains the same there will probably be some few private plants in the territory covered by every central station in the country. I do believe, however, that in every town or city where there is an excessive

number of these plants, the blame for a large per cent of them may be fastened on the central station.

The first fault to find with the central station is the fact that so many of them still demand excessive rates for their service, these rates being based on quantity only, regardless of the quality of the load; the load factor or any other feature that may make the business desirable. Matters are not as bad in this respect as in times past, for most central station managers are fully alive to what "load factor" means in the business; but there are still managers who think they cannot go below some certain fixed price per kilowatt hour, which may represent average costs; while the truth is, they could afford to take on some kind of business at half the rates they have scheduled. As an example there was recently a private plant purchased in one of our large cities, although the parties wished to avoid the investment, and do business with the central station. The load would average from 200 to 300 kilowatts per hour, and would be in operation from ten to fifteen hours per day. The central station refused to make any concessions whatever, insisting on their lowest published net rate of three cents (.03 cts.) per kilowatt hour, claiming they would lose money if the business was taken at a lower rate. This stand of the central station combined with the fact that coal was cheap, explains why one private plant was installed; and doubtless there have been hundreds of others that have been installed under like conditions.

Another fruitful source of private plants is the lack of a healthy co-operation between the central station, the local contractors, and the large manufacturing companies. The local contractors may be of great assistance to the central station, and on the other hand they may be a stumbling block in the way of much new business. They are naturally in a position to hear of many new concerns, to hear of proposed changes in power, and are often asked to bid on this new work before the central station representative could learn of the matter. It is easy to see that if the contractor had the proper feeling for the central station and would notify the manager or contract agent of all the various moves of which he has knowledge, much valuable business would be acquired. On the other hand, much of this business will probably be lost if the contractor has a grudge against the central station and spread the belief that its rates were high, its treatment of the public unfair, and the best thing to do would be to install a private plant and be independent of the lighting corporation, etc. Experience has proven that the good-will of the contractor is a valuable asset and that he can make a most valuable booster for central station service; but in order to get this hearty co-operation, and the benefit of this boosting, the central station must stand ready to do its full share. It is not reasonable to suppose that the contractors as a whole will be very enthusiastic central station boosters, if the central station cuts into their business by selling fans, heating apparatus, and supplies at cost, if it does wiring at cost, or near it, or if all the business the central station representative can give out is all thrown to some one contractor.

To keep away from cutting into their revenue, to divide the central sta-

tions work impartially among them, and to give them all a fair chance at the new work of which its representatives have knowledge, is to have the good will and co-operation of the local contractors. It requires considerable diplomacy on the part of the management, and the giving up of some profits to accomplish these results; but the benefits received in many direct and indirect ways more than offsets any such small losses.

What has been said of the local contractors as valuable allies applies with equal force to the electrical manufacturing companies. They, even more so than the contractors, are called upon to bid for new machinery, motor equipments, etc., many months before plans are made public, and usually before the central station representative could possibly learn of these things. It is easy to see the benefit that would come from having the hearty co-operation of these companies, for in addition to being posted on all such new concerns, contemplated changes in equipments, etc., the representatives of these companies often make quiet but effective boosters for central station service. The central station should be, and usually is the largest purchaser of electrical apparatus in the territory which it serves, and all of the electrical manufacturers are naturally very anxious to receive their share of this business. Then, too, the motor business which a wide-awake central station can turn over to them in the course of a year will largely outbalance the few private generating plants they might install in competition with the central station. Everything considered, it is to the advantage of the contractor and manufacturer to co-operate with, and insist, the central station in getting out and keeping out private plants, provided they receive a square deal, and get a fair share of the business; and it behooves the central station manager to see that they do receive a square deal in every way, for while there may at times be a slight monetary loss, the final results justify it in every way.

To get out a private plant after the plant has once been put into operation is usually a very difficult task, especially as long as the operation is fairly satisfactory, and it is not to be expected that they may all be gotten rid of without a long and hard fight. This is a time of keen and sharp competition, and the successful merchant or manufacturer will not abandon his plant simply because the central station representative tells him it will be better or cheaper for him to do so. He must be shown wherein it will be better, and the figures must be produced proving that it will be cheaper. To produce these figures it is often necessary to make an actual test on the premises, determining the kilowatt hour consumption, cost of coal, cost of labor, and all other items that enter into the finished cost. For many small plants such a test will show a rate per kilowatt hour so high that it may easily be closed down without further trouble. For the larger plants the cost are often more nearly that of the central station itself and of course the margin to go on is not so large. However, there are few owners of plants that are not willing to pay ten or fifteen per cent more for light and power in order to rid themselves of the annoyance of a plant. Knowing the cost of a private plant it is largely a matter of meeting this price and hammering away at its owner until it is

finally closed down. Of course this is much easier said than done, but it can be done by everlasting hammering away and at last putting in an appearance at an opportune moment after some break down or serious trouble, for such trouble is bound to come sooner or later to every private plant. Or, if no mishap occurs, the owner of the plant may often be persuaded to close the plant down for a year, during this period using the central station's service, in order that he may determine the desirability of purchasing his light or power, rather than attempting to generate it himself. If necessary, it is advisable to take this business for a year's trial at a flat rate—this flat rate to be determined by his costs of the previous year. At the end of the year's test a long term meter contract may be entered into at whatever rate the test shows the consumer is entitled to, and there are not many people who will go back to a private plant after a year's use of central station service; provided, of course, this service is what it should be, and if it is not reliable and satisfactory it had better be made so before attempting such trial propositions.

It is often the case that private plants, especially lighting plants in business sections, supply light to adjoining buildings. In making tests on such plants it is always wise to meter these circuits, and knowing the consumption of these parties, to go after their business. Often such parties buying current from a private plant, are the victims of high flat rates, defective meters, and the manipulations of meter readings, inefficient lighting units, etc., and it is often easy to take away much of this business from the private plant. This is very desirable as it makes their cost per kilowatt hour that much higher, and makes it easier to close the plant down in the end.

There are many small lighting plants, and this applies more to gas engine than to steam engine plants, that may be closed down by the central station recommending some more efficient system of lighting. Take, for instance, a store light with clusters of carbon filament lamps, or old style arc lamps. As long as this system of illumination is adhered to, it may be impossible for the central station to get the business; but if they will recommend or even furnish the first installation of Tungsten lamps, a satisfied consumer and valuable business may be secured without much trouble or expense. There are no doubt many small plants in every city which could be put out of business forever by a little persistent work, and showing the owner of the plant how to get better results with the latest and most efficient forms of illuminants.

In the private plant that is supplying power, it is just as important that a thorough test be made showing the finished cost per kilowatt hour, as in the case of the lighting plant. Such a test is often all that is necessary to take over the business, and for those plants where the cost is near the delivered cost of the central station the same tactics may be followed as were outlined for the lighting plant, such as getting in on a year's trial and if necessary at a temporary flat rate. Many small power plants may be closed without a great deal of trouble by the central station representative pointing out a more economical arrangement of line shafting, sub-dividing the load, and in other ways

cutting out useless friction, and making power as purchased from the central station much cheaper and more convenient. It is often desirable, where the central station representative is sure that a saving can be effected, but where the prospective customer has his doubts and will not risk the investment without being sure as to the costs of operation, for the central station to loan the necessary motor or motors for a sixty or ninety day trial, so as to prove the point. In these cases it is better to let the prospective customer stand the expense of installing the apparatus, but if necessary it is good policy for the central station to assume one-half, or even all of the cost of installation. Where it is necessary for the central station to assume all of the risk a written proposition should be made the prospective customer, offering to furnish and install a motor of certain horse-power, speed and make for a reasonable length of time, it being specified that if at the end of this trial period, the power and the cost of operation is satisfactory, the central station is to be reimbursed for the cost of the wiring and for the motor itself, the exact cost of each being set forth. Of course, it is not advisable to make such a proposition to every prospect, and great care and judgment should be exercised to make sure that an unfair advantage is not taken of such offer. It will be found, however, that a judicious use of such trial propositions will result in the securing of much valuable business that would probably never be secured in any other way.

Such trial propositions, valuable as they may prove in closing down existing plants, are even more valuable in keeping private plants from ever being installed. Often a manufacturer in erecting a new factory is at sea as to his power equipment, and will gladly receive suggestions from the central station representative as to the horse power requirements, best methods of arranging machinery, line-shafting, etc. In this way it is often possible for the central station to have a new factory equipped with motors either A. C. or D. C. depending on the location, and have them so arranged as to get best economies, with the understanding that the factory will operate on central station current for three, six or twelve months, until demand, load factor and rate can be intelligently determined. In small shops and factories it is even advisable to loan the motor or motors, and if necessary do the wiring, as a very small percentage of such new shops need be lost, as experience has proven that it is very much easier to keep a new shop laid out for motor drive along right lines, than to displace an existing plant, where everything is on one shaft, and the arrangement often the worst that could be imagined.

Such a proposition as that outlined above, for the prospective customer to use central station current for six months or a year until a rate may be fixed, applies with equal force to a strictly lighting load, although only power consumers were spoken of above. The owner of almost any office building, or building of any description will consider such a proposition, and the central station's service, once having been relied upon for this length of time, is seldom abandoned.

Doubtless there are many central station men who will criticise the ideas

advanced regarding trial propositions, but we should remember that it is a great game we are playing, and we cannot reasonably expect the customer, or prospective customer, to take all the chances. To make others believe in our proposition, we must stand ready at all times to prove that we believe in it ourselves; and the man who advances the idea to the prospective customer that central station service is the best and most economical, when he himself does not believe it with his whole soul, is a fakir pure and simple, and for the benefit of all concerned, should be eliminated.

One word as to results. A medium sized central station has consistently followed a course, as mapped out in this paper, for two years. During these two years, gas and steam driven plants have been displaced by central station service, the aggregate of such plants being more than 1,500 horse-power, while about an equal amount has been added to the connected load in new buildings and factories, where the owners first considered some other form of power. The central station that has never adopted such a policy will find that it pays to do so.

Have faith in your central station proposition and then prove it to your private plant prospect.

Discussion.

President Tait: Gentlemen, this paper is open for discussion, and I hope you will discuss it freely. It indicates a means of getting out private plants that is well worth looking into.

W. C. Anderson (Canton): I might say that we have a city of now about 45,000 population, in which there is not a single isolated lighting plant, and has not been for a number of years.

President Tait: I would like to ask the gentleman how many were there when you started, and how did you get them out?

W.,C. Anderson (Canton): We did not get them out. We kept them out. We have there two large hotels, one of which is of considerable size and has a plant in the basement. One of them has operated about two months, and the other has made two attempts at operation. In the one case I went to the owners when they were about to open the hotel and told them it was foolish for them to put in that plant, that we could sell them the current cheaper than they could make it themselves. But they had made a lease for the hotel, and in this lease was a clause that there should be a private plant installed. They did not care about breaking the lease in any way, but the prospective proprietor of the hotel was insistent that the plant should be installed so that he could gratify a grudge against the electric light company. However, it did not take very long to prove that the assertion we had made to the hotel man was true. I might say that we were aided by the fact that shortly after that he had President Roosevelt there and a very large number of other national celebrities. Just before that one of his engines went to smash, and he was very much afraid lest something should happen when the president got there, and he came to us for a break-down service. We ex-

plained to him that to hold ourselves in readiness to furnish break-down service was worth money to us, inasmuch as it tied up part of our capacity, and if we agreed to give it he would have to pay for it. He said, "Why, if I pay you for that, then my plant is no good to me." I said, "Of course if you put in a plant that is as reliable as ours it will cost you a whole lot more than what we would charge you." The result was that in something like a month and a half he concluded to sign up on a flat rate.

President Tait: Are there any other central stations here that are having trouble with private plants? If so, now is the time to discuss the matter.

W. M. Adams (Elyria): There were a couple of private plants in Lorain, and both of them regretted that they ever put them in. It happened that the owner of one of them was a stockholder in a gas engine company, and to help along his stock he bought a gas engine and put in a private plant. Inside of thirty days he told me that he was sorry he ever put it up. There is another private plant at the same place that took on several customers along our line. He is about ready to give it up. Some of his customers have come to me and asked for break-down connections. I had a case of that kind a few days ago. I said, "Yes, we will give you break-down connection, but you will have to guarantee us so much per month, whether you use 1 m. or 100 m." He said, "Why, we will pay you for what we use." I said, "Oh no, we will not do anything of that kind. If I were running a livery stable would you ask me to keep ten horses subject to your call when you only wanted one? You pay us a certain amount for break-down connection, and then you use more or less as you wish."

B. H. Gardner (Dayton): I would like to ask Mr. Anderson whether there are any private light plants in the factories in his town?

W. C. Anderson (Canton): Yes, in practically all of the factories they run their own power and supply light as well. We have factories that probably have more power installed than we have. There are some very large factories there in which machinery is installed power for which no central station could supply at a profit. If our plant was large enough so that a load of 1,000 or 2,000 k. w. thrown on in half a second would not interfere with our regulation, it would be all right. We have a brewery and a rubber factory, neither of which I think could be carried profitably. The rubber factory has a high-pressure system carrying 80 pounds steam, which is also used for vulcanizing. There is a reducing valve on the engine, which is of the old slide-valve slow-speed type. Economy of operation is no object with them, and the fuel cost for their power is little or nothing. No ordinary central station can reach that class of customers profitably unless it is equipped to furnish live steam at high pressure at a long distance away.

F. D. Elwell (Sidney): Several factories that I know of have their own dynamos and are running large steam plants, so that it is hard to get their general lighting business, but we are able to get quite a nice little business from their night lighting, etc., and turn it right into their regular system. We limit their supply by fuses or circuit breakers. In that way we do not have to

supply their full capacity and get nothing in return for that which is tied up; for instance, in the case of a factory that has something like 200 lights wired up we would give them, say 35 or 40 light capacity, and get quite a little business out of them in that way.

President Tait: Do you charge a price of so much per k. w. connected in a case of that sort?

E. D. Elwell (Sidney): We have not found it necessary to do that in the cases we have taken on, of which there are several.

President Tait: But your idea would be to do that if they did not use enough?

F. D. Elwell (Sidney): Yes, sir.

W. C. Anderson (Canton): We have got the majority of the factories connected for limited service after closing hours, and we limit them by a charge of 15 cents a month per 16 candle-power lamp, unless there is a stipulation that they are not to use it on our heavy lighting hours in which case we have special rates for the particular case.

President Tait: It seems to me it is very wise in trying to get out private plants to see that people get break-down service, if they want it, at so much per k. w. capacity. It makes it prohibitive to buy it that way, which drives them to buy current entirely from the central station. Frequently the engines in private plants get to a point where they will not run continuously after a number of years, and the owners ask for break-down service to protect themselves. If we charge them a price sufficiently high to guarantee the central station, the consumer finds it will be to his advantage to take all the current and get a rate accordingly. I think this is a very good plan to follow up, but you ought to get a price per k. w. capacity based upon your service connection.

F. D. Glosser (Marion): I would like to ask the gentleman from Dayton what he would do with a planing mill where they have to get rid of their refuse?

B. H. Gardner (Dayton): We have done very little on that line, and have had no success with that. There are a great many places where they sell refuse. It is simply a matter of getting a market for it. They use it in livery stables for bedding, etc. They also sell small blocks for kindling. In the majority of cases they have to have dry kilns and must have steam for that purpose, and then it is a very hard proposition.

W. C. Anderson (Canton): We have the majority of the lumber yards in Canton equipped with a few machines for operating wood working tools. We took on about the only exclusive planing mill there last year. We made them a flat rate. They are entirely off of our heavy lighting hours. Our Edison mains pass right in front of them, so that it does not cost us anything for the connection, and they do not use it during the hours when artificial light is required. You will find with a great many planing mills that you can probably make an arrangement with them never to use any power at all during the hours that artificial light is required.

S. F. Messer (Warren): We furnish both power and light for the planing

mills at Warren, and they use a good deal of their refuse under their own boilers to make low pressure steam for their dry kilns. We have furnished power for one planing mill I think now for four years.

Paul Sentman (Wagner Electrical Manufacturing Co., Cincinnati): In connection with planing mills I have a suggestion to offer. In one case we installed motors for running rip and cross-cut saws. The manager of that yard tells me that he can buy lumber, say 2x8 or 2x12 so much cheaper than he can buy 2x4, I believe \$2.00 a 1,000 cheaper, that he can run that through his own machines, cut it up and perhaps save from 30 to 50 cents per 1,000 feet; so that he makes quite a saving in the cost of his small sized lumber. If that is brought to the attention of other lumber yards it might be the means of installing motors where otherwise they would use no power at all.

President Tait: I would like to ask some of the central station men if they have had any experience in exchanging electricity for by-products of lumber, for instance, sawdust and shavings, to be burned in their own boilers to generate steam. That proposition has come up in Dayton for action, and they are struggling with it now. There is more refuse lumber in Dayton than in Cleveland, Columbus and Cincinnati all put together. If we could find some means of burning that under our own boilers we could sell electric power to those people. I would like to know whether anybody here has tackled that proposition as yet?

B. H. Gardner (Dayton): I would like to ask the central stations what they do with the refuse? Do you know approximately what power is connected in your planing mills? We have in Dayton I suppose eight or ten planing mills that have over 100 horse-power each. Some of them have 200 or 300 horse-power, also chair factories and such things as that. There is one other that has probably 400 horse-power connected. Have you had any success in handling planing mills, etc., where they have dry kilns?

W. C. Anderson (Canton): Fortunately our planing mills are smaller than yours. A couple of them have 50 horse-power on maximum load, and the only case I have known of at all of a large mill being handled from a lighting plant was where they built the lighting plant pretty close to the saw mill for the sake of having their sawdust and shavings delivered by a fan. That is a matter that would have to be worked out; but I doubt whether there will be sufficient profit to the central station plant to justify the hauling of sawdust and shavings and small pieces of kindling any great distance to burn it under another boiler.

S. F. Messer (Warren): The plants at Warren have each about 125 horse-power connected. The saving to those plants was such that their monthly bills for electric service about equalled the weekly bills before. So you can see the difference.

B. H. Gardner (Dayton): I would like to ask what average monthly k. w. hour consumption those mills will show? Was the friction load very heavy, that is, much greater than the average working load? That often makes a great difference.

S. F. Messer (Warren): The saving was in the elimination of the shaft drive. They changed from a very large shaft to a group drive; and also, in the engineer's salary, etc.

B. H. Gardner (Dayton): They do not need any dry kilns?

S. F. Messer (Warren): They still burn refuse, as I said, for low pressure steam for their dry kilns.

B. H. Gardner (Dayton): And do not have to employ a fireman?

S. F. Messer (Warren): No—not for that purpose.

B. H. Gardner (Dayton): The law states that for anything over 30 horsepower you have to have a licensed man.

President Tait: Is there any further discussion? If not, we will proceed to the next subject, "Electric Signs, Outlining and Other Special Uses of Electricity as an Adjunct to Profitable Central Station Work." Papers on this subject are to be read by Messrs. J. C. Rothery, of the East Liverpool Traction & Light Co., C. A. Elliott, of the Dayton Lighting Co., and H. Engle, of the Youngstown Consolidated Gas & Electric Co. We will hear all of the papers before any of them are discussed.

ELECTRIC SIGNS, OUTLINING AND OTHER SPECIAL USES FOR ELECTRICITY AS AN ADJUNCT TO PROFITABLE CENTRAL STATION WORK.

By J. C. ROTHERY, The East Liverpool Traction & Light Co.

Every central station manager realizes that the peak load is far in excess of the average, the latter frequently not being 25 per cent of the former; indeed the writer has one property in mind where the average night load for the 24 hours, (the current being on the line continuously) was only 28 per cent, the minimum for about two and a half hours being nineteen per cent. It, therefore, behooves all central station managers to provide if possible for continuous consumption of his product.

One of the methods of doing so will be displacing steam power for light manufacturing purposes between the hours of, say 7 a. m. and 5 p. m., as it is during this period that the consumption of electric current is at its lowest point. The manufacturer's aim is to make his product better than his competitors and at a cheaper rate. If he does not do this he will be passed by his competitor. It is evident that the central station manager has the same object, to make his product, electric service, better and cheaper; and the way to obtain a cheap product is to operate his station continuously as near its most economical point as possible, which is the full capacity of the plant.

In placing the advantages of the use of electricity for power purposes before a manufacturer, the central station manager will point out that his service is absolutely reliable and is available at all times, day and night, extreme

care being taken by the central station to assure a continuous supply of current every minute of the 24 hours; a competent and thoroughly organized staff being maintained for that purpose; the lessening of the probability of labor trouble; the elimination of the difficulty of obtaining coal in times of scarcity of such; congestion on the railroads, or coal strikes, the central station assuming these risks; the absence of liability to accident in the factory power plant, and the elimination of many features which are annoying and expensive, such as smoke, coal storage, removal of ashes and expense of cleaning.

The central station manager can afford to furnish power during the daytime at a low rate. The additional cost of the power so furnished being principally the cost of the extra coal, water, lubricants, waste, etc., which is a very small additional percentage to the operating expenses of the power house in furnishing electric current necessary daily to supply the peak load; the fixed charges being the same independent of output, therefore, the central station manager can afford to sell current during daylight hours at a rate even less than the cost of manufacture for peak load only.

Another use for current which is consumed during the hours of light load is in the operation of all household utensils such as motors for washing machines, sewing machines, electric irons, chafing dishes, coffee urns, tea kettles, etc.

The special advantages to a central station manager in the consumption of current for these purposes is that he receives for it the rate upon which the rates are based for residential lighting, and thus all electric household appliances are per k. w. hour, the most profitable adjuncts to a central station. It will be found that where one or two electric flat irons, chafing dishes, tea kettles or coffee urns have been introduced in a neighborhood, the demand for such will rapidly increase. We believe that special effort, therefore, should be put forth by central station managers to introduce such appliances.

The field which will appeal to the mercantile community and from and by which central stations may materially increase their revenue with a comparatively small additional investment, are electric advertising signs. Outlining of buildings should be included in the same category as signs, being in fact an integral part of a similar advertising system. It may be necessary in order to introduce electric advertising signs for a central station manager to purchase a few, receiving payment for the current only. Such a course will undoubtedly tend to add a number of other customers along the same lines, particularly if an active canvass for this business is instituted and maintained.

We would suggest that signs be charged at a flat rate, based upon a flat weekly rate of about 4 cents per 2 candle-power, 10 watt lamp. This would give a sign bearing 50 lights for \$2.00 a week, burning every night and averaging 6 hours per night the year around; and would produce an income to the customer not exceeding \$2.00 per week; we feel assured that such an arrangement would be satisfactory to all parties. To the central station manager on account of income in proportion to his investment and cost of

production, and to the merchant as a profitable advertising investment. We would, therefore, say that electric signs are of great value to central stations.

First: Because they give opportunity to increase their average load without extending existing lines, as the ordinary merchant using electric signs is generally located in the central part of the city through which the lines must necessarily run, so that when a merchant puts up a sign it requires very little, if any, extra expense on the part of the central station manager more than if twenty or more incandescent lights had been added to the store. This would apply to where electric signs are on a meter. Where, however, electric signs are put out at a flat rate as hereinbefore outlined, a separate feeder line may be required and controlled from one point which may be a given point in each locality, or one central point, namely, the generating station. With a flat rate contract you control absolutely the hours which the sign is to burn, and can in this way when necessary keep the sign load off the peak load, if it is found desirable. With a contract of this kind conditions assure you of a steadily burning load six nights in the week, the value of which can be readily appreciated.

I would suggest that the secretary communicate with central stations throughout the state, asking the managers thereof for their experience and suggestions with reference to the use of electric signs, outlining, and other uses of electric current, that the same may be collated and distributed to all the members of the Association.

Electric Signs, Outlining, and Other Special Uses of Electricity as an Adjunct to Profitable Central Station Work

BY C. A. ELLIOTT, Dayton Lighting Company Dayton, O.

Electrical advertising by either of the following methods, namely, artistic outlining of buildings, electric signs and good window illumination, is second to none due to its effectiveness after dark when the people on the streets are generally speaking, free of mind, and easily attracted by the artistic designs and attractive motion signs, which stand out in bold relief with the blackness of night as a background.

Electric signs and display lighting, besides having their excellent advertising qualities for the merchant, and being good business for the lighting company are added assets to the city, as they increase its commercial standing materially. They also have an inestimable value to the lighting company, as they instill the electric idea into the minds of the people on the street at night.

Electric outlining by means of low candle power lamps is the foundation of all decorative and display lighting which is almost a necessity to the up-to-date merchant, as it offers the best opportunity for an attractive and distinctive frontage, which is absolutely necessary in these days of keen competition. This can be done with either two or four candle power lamps spaced on from ten inch to eighteen inch centers following the lines of the building, the floors, and windows. There are many excellent examples throughout the State of Ohio, of artistic outlining.

The electric sign, with which the merchant places his name and goods before the public, along with the distinctive frontage, the result of outline lighting, cannot be equalled from an advertising standpoint. The flashing sign is even more attractive than those of steady burning, but those showing motion, which are the latest development of the flashing type, are particularly attractive, due to the fact that the cause of motion is not apparent.

Along with the above, window lighting should not be overlooked, as this is the base of advertising from the merchant's standpoint, as it is the means of displaying his goods.

There are various methods of caring for these different classes of business but those which, I believe, appeal to the central station manager as well as the merchant, are as follows:

THE ELECTRIC OUTLINE

The lighting company to install the necessary wiring, conduit and lamps, on a two year contract, the consumer to pay for the construction of the outline by monthly payments of six to twelve in number.

THE ELECTRIC SIGN

The merchant to purchase sign and have same hung complete with wiring, ready for meter. The company to furnish the lamps on a two year contract.

All decorative and display lighting should be controlled by the lighting company on an "off the peak" schedule. The hours of burning is what determines the desirability of the business. Therefore this should receive very careful attention. They should be entirely "off the peak" and, if turned on at five thirty p. m. during the winter months and at dusk during the summer months and burning until eleven or twelve o'clock each and every night, they will, in most cases, be after the "peak" load and, therefore, worthy of a low rate, as it materially increases the load factor of the station, thereby reducing the cost per kilowatt hour generated. A flat rate should be charged for such service, as this appeals to the merchant, and would come under the head of fixed expenditures for the month. The monthly charge would be based on a stipulated rate per lamp, per year, say two dollars for four candle power lamps and one dollar and forty cents for two candle power lamps. This allows about a six cent rate for current, together with switching charges and one half the lamp cost, and makes a very flexible and satisfactory rate.

Too great care cannot be exercised in the maintenance of all display lighting, as a very ragged appearance is produced by a few lights being burned out, and this is detrimental to the lighting company as well as to the merchant.

The window lighting should be handled along practically the same lines as the flat rate lighting. It may be found desirable for the merchant to have the privilege of turning on the lights earlier than the sign schedule, same to burn until eleven or twelve o'clock, and then to be turned off by the regular sign man employed by the lighting company. This would also be good business as the greater portion of the service is "off the peak." A meter rate of from six to seven cents net per kilowatt hour can be charged for such service.

After the merchants are loaded to the muzzle with signs, outlines and other display lighting, another excellent class of business is street illumination either by arches from curb to curb, strings of incandescent lamps on curb lines, or boulevard arc lighting, all of which should be controlled on the same "off the peak" schedule. This should, however, be the last proposition to suggest, as, if installed first, it will destroy all opportunities for signs, or outlines as the merchant will insist that he is paying for his share of the street illumination, which lights the front of his store in good style, and is satisfactory to him, at least for the present,

Electric Signs and Other Special Uses of Electricity as an Adjunct to Profitable Central Station Work.

BY H. ENGLE, Youngstown Consolidated Gas & Electric Co., Youngstown, O.

It was my understanding in the beginning, that I was to prepare a paper on electric signs to be read before this convention. Later on, "Other Special Uses of Electricity" was added to the above. As for the different uses of electricity, conditions demand that I confine myself to just one or two.

We have been unfortunate in the handling of cooking apparatus and I prefer to listen to some one of you on this particular subject. We are at the present devoting considerable time to electric signs, and not having yet begun our outlining campaign, I will also have to pass that up, confining myself entirely to electric signs and flat irons.

FLAT IRONS

We are having considerable success in connection with the pushing of flat irons this summer, using three methods in advertising and putting out irons. The first is through our regular channels of advertising, the newspapers, our bulletin, etc. The second by putting out a wagon and canvassing from house to house. The third by the employment of some one in the office, preferably a young lady, who puts out flat irons by directly 'phoning to certain people.

The first of these methods is good, and must be carried to some extent by everyone; the second is very good and we have had better success with this than by any other method. The wagon carries large placards announcing the fact that we are delivering irons and putting them out on thirty days free trial. Wherever our wires run into a house, we call and demonstrate the iron and very seldom do we fail to place one. The third method is also a very

good one, and I am sorry we have been unable to do more of it. In pursuing the last plan, I find it best to do most of the 'phoning on Monday and Tuesday. On Monday for the reason that most of the people are washing and expect to do the ironing the next day; on Tuesday for the reason that the women doing ironing in the old way are sweating along and most apt to consider such a good proposition. It is highly desirable that the young lady doing the 'phoning is possessed of a good voice and great tact.

We replace, free of charge, all burned out units in flat irons. If people are given to understand this before purchasing, or even trying, you will have no trouble in putting out irons. Once they are out and the element of added cost for burned out irons is eliminated, you will have no trouble in keeping them out. The big mistake most every lighting company makes, is in not keeping in close enough touch with all classes of consumers and I know of no better way to keep close to the residence consumer, than by putting out small units, of which I consider the flat-iron one of the best. A consumer may have been using electricity for lighting purposes for several years and probably visits your office once a month to pay his bills, but as to who you are and what you are doing for him, he only knows in a vague sort of way. Just suppose that every time you looked down at your shoes you saw plainly a card or a label which reminded you of the fact that the shoe was of the "Wearwell" make and you bought them from John Jones. I consider the flat-iron as just this sort of a reminder, something which the house-wife must know that you and you only put out, and that you are the only one who can furnish the means whereby this time saver can be operated.

ELECTRIC SIGNS

So many electric signs have been installed in most every city during the past few years and the increase in revenue from the addition of these signs is so marked, that the ordinary central station man is convinced that signs are a good thing. Yes, he believes in signs. Aside from the actual revenue derived from electric signs, other phases enter into the situation which are just as valuable to C. S. M. as the revenue itself. Results prove that an electric sign will actually sell goods. I have in mind a man who installed a handsome sign in one of our amusement parks, the sign advertised "Zig Zag," a popular confection of the day. The first night the sign was installed, every package of "Zig Zag" in the park was sold and the telephone wires were almost burned up in an effort to get more. Result, one more satisfied consumer.

This is neither a new or a strange condition of affairs. Did you ever see a man who owned a good live sign, yet was not a satisfied consumer? We will venture to say, not many. There is something so agreeable in the ownership of a handsome sign, a man feels so proud to be referred to as the owner of such a sign, and selling results are so sure that right here you have a basis for the friendly feeling which must exist between the consumer and the C. S. M.

Before buying, your consumer knows something about the advertising value of his sign. He knows that nothing attracts so well as light, he knows

that to be business getting his advertising must be persistent and what is more persistent than his own sign, burning brightly before his very door, stamping indelibly on the minds of every passerby, his name and his wares.

It is to be expected that you visit all your customers just as frequently as possible. If one can be induced to use your current for advertising purposes, he is immediately placed in that class which must be visited even more frequently. Your visits will certainly turn his talk toward electric light matters. It may be his sign or it may be the lights in his own or some competitor's window, but he will surely talk about electric light. When you can induce the body of merchants to talking about you, your doings or your business, you have certainly arrived at that stage in the advertising game for which we are all striving.

Don't sit on your oars once a sign is installed. Your consumer is not getting the full advertising value of the money invested in his sign and you are not receiving the maximum amount of revenue unless you can induce him to burn until a fairly late hour every evening. All electric signs should properly burn until the theatres are closed for the night and efforts should be made which will bring about this state of affairs. An electric sign is a real courtesy to the people on the street, and a courtesy which is appreciated as evidenced by the fact that of two stores, one having a dark front and the other with a bright sign above the door, the latter will get the business.

The following are a few good reasons why an electric sign is a good thing for the central station man:

- 1 You are receiving near the maximum amount for outside without lowering in any way your revenue from the inside lighting.
- 2 With the means furnished by you, your consumer is boosting his own business with the result that he is a satisfied consumer.
- 3 You are giving a flash to the street which leads people to know that the light company is alive and on to their jobs.
- 4 You are teaching your consumers to use more light, for if his sign has been a success, you will have no trouble in closing him up for some other proposition which requires the use of more light.

Discussion.

C. R. McKay (in the chair): Gentlemen, these papers are open for discussion. Are there any remarks?

T. D. Buckwell (Toledo): A while ago we were talking about power. In Toledo we are putting in motors in school buildings for ventilating purposes. We have 25 schools equipped with motors of $7\frac{1}{2}$ to 15 horsepower each. They are on from 8:00 o'clock in the morning until 3:30 in the afternoon. When the schools close the motors are shut off.

Secretary Gaskill: In line with what Mr. Buckwell has stated, we have one installation of that kind in Greenville which has proved very satisfactory, not only to the Company, but also to the Board of Education. When the school house was first built two gas engines were installed to operate two blowers in the building and they gave an unending amount of trouble arising principally from two sources; first, because the janitor generally in charge of a school building knows very little about the operation of gas engines; second, in the installation of the small unit gas engine such as is needed for that purpose you do not get a very reliable engine, and as a consequence those engines gave the board plenty of trouble. I happened to be on the Board of Education at the time, and upon tracing back I found that the board were paying for repairs on those two gas engines about \$80.00 a year besides the cost of gas for operating them. The Board of Education considered the matter carefully and decided to install electric motors during the school year of nine months. That is entirely a day load, as Mr. Buckwell says, from 8:30 in the morning until 4:30 in the afternoon. They have averaged the Company about \$10.00 per month for both and we have found them a very good source of business, while the Board of Education has not had to pay out one cent for repairs since the motors were installed.

In line with this I would state that the matter of ventilation of public buildings is getting to be a burden to most of the various bodies that control them, and the laws of the state will soon require that every building occupied by a considerable number of people shall have a ventilating system operated by forced draft. This is a line of work that central stations ought to look after and push, because it is nearly always a day load, and is exceptionally good business. Churches, school houses and various public buildings can be made profitable users of power for ventilating purposes and those who have to occupy them greatly benefitted in health thereby.

W. C. Anderson (Canton): As another use of electricity I would like to call attention to the electric suction sweeper, especially for use in school buildings. Any one of us who has ever visited a school building has noted the enormous amount of dust held in suspension in the air. There are a great many little feet tramping around, and little shoes carry in a great deal of dust. The Janitor when he sweeps up only stirs up the dust, and gets very little of it out. Vacuum sweepers are now in use that lend themselves very well to this kind of buildings. We have probably 30 or 40 of them in use in

Canton for residences, and the ladies who use them would not part with them on any account. While the revenue from such a source may not be very great in any one instance, yet if we could get them into general use for public school buildings and in places where they are of prime necessity, we would add to our revenue as well as doing something that will promote the health of the children. I think the matter should be agitated throughout the state and before very long something of the kind would be required by law, while there would be a very considerable revenue to the lighting companies in the aggregate.

President Tait: Gentlemen, I would like to suspend our routine temporarily, to perform a very pleasant duty. I will ask Mr. Anderson and Mr. Buckwell to kindly escort Prof. Pickering and Prof. Lord to the platform. They have kindly consented to come here and say a word to you.

The Special Committee now escorted Prof. Pickering and Prof. Lord to the platform, where they were received and greeted by President Tait.

President Tait: Gentlemen of the Ohio Electric Light Association, it gives me great pleasure to introduce to you Prof. Edward C. Pickering, Director of the Harvard University Observatory, who is here in his capacity of President of the Astronomical and Astrophysical Society of America, and who is accompanied by Prof. Lord, of the Ohio State University. We have asked these gentlemen at an earlier period, as you know, to participate in our convention if they could. They have received our communication and have come here to personally express their appreciation. I am sure we will all be glad to hear from them.

President Pickering addressed the convention as follows:

REMARKS BY PROFESSOR E. C. PICKERING, PRESIDENT ASTRONOMICAL AND ASTROPHYSICAL SOCIETY OF AMERICA, AND DIRECTOR OF HARVARD COLLEGE OBSERVATORY

Mr. Chairman and Gentlemen: Mr. Lord and I have been requested in the first instance to communicate to you this vote of our Society, viz: The Astronomical and Astrophysical Society of America has received with great pleasure the invitation through its members to be present at the meeting of the Ohio Electric Light Association, and in returning its thanks for this invitation accepts it in so far as the existing conflict of sessions of the two Societies will permit. Through its President the Astronomical and Astrophysical Society extends to the members of the Ohio Electric Light Association an invitation to be present at its scientific sessions, and particularly at the session of this Wednesday evening, which is to be devoted to the presentation of lantern slide papers.

In this connection I wish to express personally my thanks and interests in this Association meeting which is now in progress. The interest of us astron-

omers is perhaps more closely associated with your work than you are perhaps aware. The extraordinary development which is taking place in electric light has a very technical interest for us, and many of us in speaking of this Association feared that your interest in our papers would be much less than our interest in yours. So much is being done at the present time that we have a great deal to learn and a great deal that we can use in our technical work. Perhaps I might say personally that for the last thirty years I have been devoting myself to photometric work, and of course the question of standard light, uniform light and amount of light, and all those problems have a very personal interest to me. My only regret is that we are so fully occupied with our papers that we have less opportunity to hear your papers and see your work than we should otherwise have. I might say one word for myself, that something like thirty years ago I was invited to deliver a course of lectures before the Royal Institute of Boston on the applications of electricity, and ever since it has been a matter of the greatest gratification to me to think that those lectures were not printed, for if read at the present time in the light of the wonderful development of the applications of electricity during the past thirty years they would certainly be a much greater source of amusement to my friends than they would to myself.

I thank you very much for this opportunity. (Applause).

President Tait: Gentlemen, I want to introduce to you Prof. Lord, Astronomer of the Ohio State University. Prof. Lord tells me that he does not want to say anything but merely wants to meet you gentlemen. I take great pleasure in introducing him to you.

Prof. Lord: Gentlemen, I thank you. (Applause).

Prof. Pickering and Prof. Lord now took their departure, and the previous discussion was resumed.

Dr. W. T. Fitzgerald (Greenville): I was going to ask the gentleman who last spoke in the discussion what it would cost to install a sweeping apparatus operated by electricity? The subject appeals to me. I believe it is something that will be heartily taken up all over this state. The fact that we can sweep a school-room, church, public or private building, by means of electric motor, and do it thoroughly, is certainly a strong hygienic point, one that will appeal to the medical profession as well as the laity as soon as they become familiar with it. The question of cost might enter into the first installation. I would like to know what that would be for a plant suitable for a school building?

W. C. Anderson (Canton): I would say that an apparatus of that kind that would do the work a thousand times better than it is done at the present time can be had for \$60.00. You would be astonished that it can be manufactured in so small a compass. It costs only 1 cent an hour to operate. The particular apparatus I refer to was gotten up and is manufactured in Canton, and is being sold quite rapidly. There are also two or three other firms making sweepers. One hotel has a rather expensive equipment there, which I imagine probably cost several hundred dollars; but while you can have very fine

apparatus that will do it in a rapid and efficient manner, you can still do the same thing a little more slowly but quite as well, at very low first cost.

Dr. W. T. Fitzgerald (Greenville): How long would it take to sweep a room in a school building say 12x14?

W. C. Anderson (Canton): As it has to be applied to every portion of the surface of the floor it would take just about as long as it would to go over it with one of those little disk carpet brooms, but it does it very thoroughly.

Secretary Gaskill: Would it be practical to install that kind of a sweeper in a school building, on account of the desks and the difficulty of getting around them as they are situated in the room? Would you not have to use the vacuum system?

W. C. Anderson (Canton): I am referring to the vacuum system. They have special insulators to suit all conditions and which can be attached to this outfit. The price is \$60.00 retail, but I am not quite sure whether that includes all the connections that go with it. If it does not I think the connections would cost something like \$12.50 extra. I do not remember whether that is the retail, or the wholesale price. I only give you that to show you that it is not a serious matter. There are different forms of nozzles that can be used in school house or church work, and there are also fixtures for cleaning rugs, or anything that you might happen to want cleaned.

Dr. W. T. Fitzgerald (Greenville): Mr. President, the proper method of cleaning our school and other buildings has been a problem that has appealed to me for twenty-five years. We send our children to these places, we confine them there where unless sanitary conditions are observed they may be infected with scarlet fever or something else. If an effective process of cleaning is to be had the cost ought not to be a matter of consideration. That should be eliminated from the problem; yet until the people are convinced of that we must carry to them the cost, not only the advantages, but low cost, at least temporarily. You people are representing the State of Ohio, and I hope that you will take this home to your medical societies and to the cities and counties in which you live, and present the hygienic side of it. I want to say to you that you will find the medical societies willing to assist you.

Secretary Gaskill: I want to give you a little experience about the operation of the blowers in the school building I spoke of. I think you will all remember that when you were boys and were sitting in the school room you could often observe particles of dust floating in the sunbeams. Now in this school building where blowers are being operated when a sunbeam falls across the room you can not see a particle of dust in the air, because the blowers take the air out of the room so rapidly that they keep the air pure and free from dust. As the Doctor says, from a hygienic standpoint the argument is simply an invincible one to an intelligent Board of Education that you can thus get rid of an unhealthy condition in a school room by the operation of these blowers.

F. D. Elwell (Sidney): In my town they are considering the matter of

erecting a high school building. An idea occurs to me which I would like to have some of the members who have seen the vacuum sweepers operate pass on the practicability of. It occurs to me that a vacuum cleaning machine could be put in the basement and belted to a counter-shaft which would be thrown out of gear with some form of motor drive heating system, with pipes to all rooms connected the same as in a fire hose system. The vacuum cleaner nozzle could be connected in each room so that the janitor could use it. All the dust would be sucked down into the basement and there burned or taken care of in any other way. It seems to me that that would be a good thing. If it is not practical I would like to hear some of the brothers give me their ideas.

W. C. Anderson (Canton): In order that you may understand the mechanism, I will say that the large vacuum cleaners are belted to a motor of considerable size, and placed in the basement. Pipes are led through the building, so that a hose attachment can be made at any point. But the smaller arrangements of which I spoke are a thousand times better than none at all, although not of course quite so good as the larger apparatus. The smaller one I spoke of weighs about 45 to 50 pounds and has a $\frac{1}{4}$ -horsepower motor in a shell that is formed somewhat like the upper part of a bee hive turned upside down. Belted to the motor is a revolving brush, which will take the sand out of the cracks in the floor; so you can tell whether it will not take the dust up that is more easily removable. We have one in our show window, and I saw the boys catching flies with it the other day, which will give you a little idea of what it will do.

Secretary Gaskill: I can give an estimate of the cost of a vacuum system installed in a basement. At the Miami University, of which I happen to be one of the trustees, we are just starting or planning a new library building, and one of the requirements that we made was that there should be a vacuum cleaning system installed; and the architect obtained figures on that. He states it will cost \$800.00 to install it in the basement of the library building with the necessary piping to the several rooms, and the necessary motors and sweepers. That, however, is a complete system with pipes running to every room, with motors in the basement and necessary pumps for exhausting air. The library building itself will cost \$80,000.

W. C. Anderson (Canton): That is the kind of system that should be installed in every large school building, I should say.

J. R. Cravath (Electrical World): It may interest you gentlemen to know that at the Michigan convention last week one of the members present reported that he had purchased a small portable vacuum cleaning outfit. I believe it is one of the kind that costs about \$125.00, and that can be taken around by one man. He rents it out to anybody that wishes it, at \$2.50 a day, which of course will pay for the thing before very long. He has had it busy practically all the time, he says, since he purchased it. It has proven quite an advertisement for electric service, because only those can use it that have electrical connections.

President Tait: I might say that as recently as last week a vacuum

cleaning company that manufactures apparatus of that sort in Dayton decided that they would like to test the machine. Upon learning that I suggested that they bring the machine over to our office building and locate it on the sidewalk. We offered to furnish electric current provided they would clean all the rugs and carpets and the office in general for the use of the current. They accepted the offer. The apparatus has a glass indicator showing the amount of dirt coming through the suction pipe. It was a very interesting demonstration. It cleaned our office in a satisfactory manner and proved that the electric motor was the proper method of driving it, which is what we were getting at when we loaned them the motor to make the test.

It seems to me that this is a good time to take up one of the questions from our question box, viz: "What percentage of gross receipts can be profitably spent on pushing new business, and how much of this percentage should be devoted to advertising?"

I am sure that we have a number of men here who could answer that question satisfactorily and properly. If no one else cares to take it up, I will say that I believe that from 3 to 5 per cent of the gross receipts of a company may be safely spent for new business getting, and about $1\frac{1}{2}$ or 2 per cent for advertising. I do not know what the experience of others has been on that subject, but I believe that a percentage similar to that will work out all right in practice. I should think that Mr. Clarence W. Lee might enlighten us on that subject. He deals in that sort of thing occasionally.

Clarence W. Lee (C. W. Lee & Co., N. Y.): I would say that the percentage named is probably the average that can be reasonably spent by most of the central stations, unless conditions are acute and retrenchment is necessary. To secure new business the larger amount named can be advisedly spent, possibly about 2 per cent for advertising and 5 per cent of the gross income for new business getting. That proportion is very small for a small central station; but sometimes effective work can be done for a small expenditure if it is properly spent.

President Tait: Here is another query from the question box: "What connected load in 16 candlepower equivalents per capita of population can be reasonably expected in Central Station work?"

In other words, where is the point of saturation in the getting of new business in 16 candlepower equivalents?

W. C. Anderson (Canton): I would like to ask whether that 16 candlepower equivalents refers to light only or to the entire connected load?

President Tait: I would say to change that and make it 50 watt equivalents for lighting, outside of power and other uses. What do you say to that, Mr. Anderson?

W. C. Anderson (Canton): We have at the present time about one and one-half 50 watt equivalents per capita. I should say that when we get up to about five that that will be the saturation point. I believe that that is putting it to considerable of an extreme. If I had spoken some years ago, I would

have made it very much lower. If I should be speaking some years hence, I might make it higher; but that would be my estimate at the present time.

President Tait: Do you believe there is any point of saturation in the electric lighting business?

W. C. Anderson (Canton): There most certainly is.

President Tait: We have a little time left, and I want to suggest that the associate members here who have exhibits in the lobby will interest themselves in communicating to those associate members that are not here the fact that Prof. Pickering suggested that his people would like to have the various appliances out there explained to them. He said that the members of his society in attendance on their convention, of whom I believe there are not over 25, have been very much impressed by the display made by the associate members here; so it occurred to me that this is an excellent opportunity for our associate members to illustrate that they have used good judgment in bringing the apparatus here. I suggest that you spread the word among those of the supply men that are not present and who have exhibits, that Prof. Pickering would like somebody to show them the apparatus. I suggest that a committee be appointed from the exhibitors for that purpose and that they place themselves at the disposal of Prof. Pickering.

In the absence of Mr. F. H. Plaice, of Hastings, Mich., his paper entitled "How Can We Best Increase Our Business," will be read by Mr. Gaskill.

How Can We Best Increase Our Business

BY F. H. PLAICE, of Hastings, Mich.

In preparing this paper, the supposition is, that the situation has been well canvassed; that the plant is able to produce and deliver to the switchboard electricity at a cost as low or lower than any other power plant in the community; that the service is reliable and dependable; that the distributing system is able to meet the demands that will be made upon it as a result of an aggressive business hunt, and that the entire force from the engine "swipe" to the president is thoroughly imbued with the determination of "making things hum."

Given these conditions, the chances are the company will make a decided success, but if any one of them is lacking, and left to go uncorrected, the result will be indifferent.

Undoubtedly, the most common cause of failure to get the proper results from a new business campaign, is lack of preparation and insufficient knowledge of the situation.

When we go into the market to sell, salesmanship becomes the great essential. Some have the talent naturally, others must acquire it, and some can never reach the goal.

The salesman in any line must have absolute faith in his wares and also in the ability of those above him, to "deliver the goods," but how much more important is this when the article to be sold is an invisible, intangible something, the presence of which cannot be determined until it is doing its work.

The electricity salesman then, must be an enthusiast, a dreamer, an engineer, an artist, a machinist, a tactician and an all-around student of human nature. He must be able to keep his temper under any and all conditions, must actually know what he is talking about, and must have the "hang on" characteristics of the bull dog developed to the highest possible point. His faith in himself and his wares must be so overpowering that the prospective customer will be dragged into synchronism in spite of himself.

To go to a large manufacturer, who, for a lifetime, has successfully operated his factory by means of a faithful steam engine, and ask that that faithful servant be thrown to one side, and that an almost unknown motive power be substituted for the well-known, at a prospective cost of perhaps several thousand dollars, all because of the saving of a fraction of a cent per horse power hour which is promised him, but of which the manufacturer knows nothing, certainly requires the very highest grade of enthusiasm and sanguine faith, in order that the proposition shall even be considered.

The moral of this then, is that the men we entrust with the selling of our output must be of the highest type. Do not do as many companies do—leave the matter in the hands of the meter-reader and the trouble-man—for, while these are both in their way, responsible members of the new business force, they are not the ones to be intrusted with the entire responsibility.

Next, where shall we seek for the new customers about whom we are talking?

We electric companies have three great fields in which our product is naturally supreme, and it but remains for us to properly educate our public in order that we shall get that to which we are entitled. First, there is the artificial lighting field; second, the field of mechanical work; and third, that great, but as yet almost untouched, field of heating.

We are therefore, safe in making the statement that our product can be and will be sold to every member of the human race and that our saturation point is so far in the future that to talk about it is laughable.

The educational phase is probably the most important of any of the many conditions surrounding the extended sale of electricity, and the one that should be studied the closest.

Tell me how many of your customers know that a sewing machine can be run by a tiny motor, which will use less current than the better known sixteen candle power lamp; or, that the special nightmare of the good housewife—washing day—can be driven to the realms of oblivion by means of electricity and a small motor, at a cost of but a few cents per hour. I will wager that at least one-half the customers of all the companies represented here, have yet to know that there is such a thing as an electric flat iron, and that probably another one-fourth do not know what the electric flat iron looks like.

Education, then, is what we must foster. The public is quick to avail itself of such meager opportunities as it usually gets and, like other willing students, learns rapidly, and you will be called upon to do many things for which the manufacturing end of your business has not as yet provided.

“How Shall we Best Educate our Community,” is, after all, the real meaning of the heading of this paper, for, if we educate the community, it will do the rest and our business will increase in direct ratio with the education.

There are many different ways of educating, such as Outline Lighting Campaigns; Sign Campaigns; Electric Shows; Summer Park Lighting; Demonstration Displays; Canvassing; Advertising; Signs; Bulletins; Circulars, etc.

If you are operating a night service only, arrange at once to run all the time and give your community a chance to show you what they think of the proposition. In making an energetic push after new business, we will find that our growth will be faster than the public at large is able to grasp, and it will become necessary to do a great deal of demonstrating. We must stand ready at all times to make a dollar and cents proposition on the probable cost of a certain service and then back it up with a guarantee. Not until we have proven beyond a doubt that we know our business and have satisfied the customer to that effect, will he or she become an active electricity champion.

Do not tell your prospect that a sixteen candle power lamp will use so many watts in such and such a time; he may ask you what a watt looks like—but talk to him in the more familiar language of dollars and cents. What he does not understand will not interest him to the point that he must be interested in order that you may do business with him.

When you are up against a motor proposition, the case requires a thorough knowledge of the power requirements of the different classes of machinery and general power usages, but is, in other ways, not a difficult problem, in order that the inevitable query "how much will it cost," may be answered.

One point before going farther, in regard to this new business hustling, and that is, the cost. Many companies think that all they are going to find it necessary to expend on the proposition is the salary of the solicitor, and that they can make about one thousand per cent dividends the first year after such a campaign. I want to undeceive them. An electric company developing its territory in the ordinary manner so as to keep about even with the usual growth of the community will probably expend upon extensions as much as it clears over all expenses, and when the same company begins to increase its business faster than normal the construction account will take wings and fly in a manner that will put the Wright Brothers of balloon fame, to shame.

When you get "A" enthused over your service, you are likely to get "B" also; and "C" and "D," and all the rest of the alphabet. Now, "A" may live on a street that you cover with your mains, but "B" may live on the next one and "D" still a block farther on, and so on to "Z." It is just as important to the welfare of your business that "Z" be hitched up at once as it is that "A" gets his service; otherwise, you are undoing a hundred fold, what you started out to do. When a prospect wants to be connected, you will find it wise to connect him, otherwise you may want him some day and find that not only is he adverse to your proposition, but he is taking every opportunity that offers to work against you.

In the ordinary course of business growth the suburbs are laid out, streets graded, and houses built after which comes water, gas, and electricity in the

order named. Under the new propaganda, the addition is planned and the electric wires strung, even before the streets are graded, so that when a house is built the service may be installed from the beginning. We must pioneer in every field, not follow.

Shall we advertise? This is a very important question, but there can be no hesitancy in making answer thereto. We must, but advertising does not necessarily imply a contract for a certain amount of space in each issue of the home papers. Far from it, for, outside of its possible good effects on the publishers themselves, it does not pay very big returns on the investment. We will admit that a limited amount of money spent in newspaper advertising is necessary and desirable, in order that the papers may take an interest in our work, but to expect large returns from newspaper advertising, is to be disappointed. The same amount spent in demonstrations will show far larger returns.

Place fans, irons, lights, motors, large and small, or any other appliances that will become a consumer of electricity in service, on trial. Ninety five times out of a hundred you will close the deal: the expenses of the five failures should be counted as that much advertising. We, ourselves, make it a rule to withhold our installing bill until the first month's service bill is presented, thus leaving the customer the privilege of a month's trial at our risk. We have installed hundreds of horse power of motors during the past few months in this manner and have yet to fall down; one case in mind involved twenty five motors which, together with the other installations, reached over four thousand dollars.

Carry the same idea into all lines of your work. For instance, a church or other organization may be giving an entertainment, and want some form of special service. It is good business policy to take advantage of all such opportunities to get into the lime light with your product. This form of advertising is rather expensive but the cost is mostly made up of labor and the returns are amply remunerative to justify.

If you have an idea in the way of street illumination that you want to present to your citizens, there is no better way than for you to go ahead and make a sample installation at your own expense, so that they may see just what you have in mind. The seeing will often win the day and bring you returns that could not have been secured otherwise. All this is advertising, and the cost of failures should be charged to that item of expense, while the successes should be able to pay their own way.

WORK——You may advertise; you may solicit; you may make attractive rates and inducements, but if you do not stand back of every proposition yourself,—I am talking to the managers now—by being “Johnny-on-the-spot,” you will fail. The manager of a wide awake electric company will not have time to make garden or mow his lawn but will be going without his dinner on many occasions. He will become an erratic member of the family

circle and a still more erratic attendant at his office desk. He will find it necessary to spend a large portion of his time on the outside in constant touch with his men and the work. His lieutenants will greatly appreciate the chance to take up difficult propositions on the spot where all the phases can be gone over knowingly and will do much better work as a result. A word here, and a suggestion there will do wonders in the general results to be accomplished. The example set will also be an incentive, and you will find that as days go by, your men will gradually wean away from the quit-with-the-whistle idea, and will be just as anxious as you yourself are to see a task finished. You will find that time will become your most valuable asset and that sleep, meals and everything else will be sacrificed to the good of the cause.

PROMPTNESS—This is one of the weak points of many companies and one that is usually the last condition to be blamed when things do not seem to come as they should. A customer calls up and reports that his lights do not burn and then lives on a hot plate until his troubles are rectified. He keeps getting hotter and hotter as the minutes fly and if he is not relieved, he may reach the danger point, and an explosion follow. Or, he may be a power user, who has a large number of employees standing around idle while he is waiting on you and yours, and here again speed in responding to a trouble call is very important. A prospective customer for let us say, power, may have an accident to his power plant and ask you to install a motor as quick as possible. Do not travel by freight in responding to such a call but do business by express. Do not let an application go without attention a minute longer than you have to, and aim at all times to make your service synonymous with promptness, reliable and economical. Train your community to the point where, when they talk about lighting, it will be understood by all that electric lights are meant, and the word "power" will be but another name for electric motors. Do this, and you will have no desire or need for asking the question, "How Can We Best Increase Our Business."

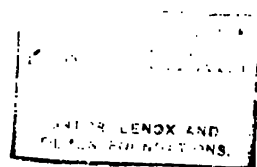
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President Tait: Have you anything to say on this subject, gentlemen?

In a few minutes a buffet luncheon will be served in the convention hall and we desire every one present to remain.

The Executive Committee has appointed the following Nominating Committee, viz: W. J. Hanley, chairman, S. M. Rust and T. D. Buckwell. Mr. Plalce's paper will be discussed immediately after luncheon, which will now be served here to save time.

A short recess was now taken for luncheon.





E. H. BEIL, Vice President.
YOUNGSTOWN, OHIO.

THIRD SESSION—WEDNESDAY AFTERNOON, AUGUST 26.

The convention met pursuant to recess, President Tait in the chair.

Discussion.

President Tait: We will discuss the paper by Mr. Plaice, which was read by Mr. Gaskill just before luncheon. Many fine points were brought out in that paper which I think we ought to take up in succession and discuss. It is a paper to which a great deal of thought has been given by Mr. Plaice, and it presents many possibilities for development. I think we ought to enlarge upon those possibilities, and see what we can get out of the discussion.

M. E. Turner (Cleveland): Mr. President and Gentlemen, I read Mr. Plaice's paper some little time ago, but was not here during all of its reading by Mr. Gaskill, and I have forgotten some of the points contained in it. The general trend of his paper I remember very well. I think it is one of the most instructive papers presented for some time in this Association. While I do not know Mr. Plaice personally you get an idea of the energy he puts into his work from the terse manner in which he has brought out certain principles of business getting and of operating a central station plant in which the manager has to assume more or less the duties of contract agent and chief engineer. The paper is full of specific points of interest to us and I think that it is well worthy a good close discussion. As I understand, in some of the work which has been done by Mr. Plaice he has developed in a certain town a revenue which I believe is one of the largest derived in any city of like population, and this has been brought about by a remarkable exhibition of energy, both in securing business and in looking after the customers after they were secured. While perhaps some of the methods adopted were original and might not equally apply in a large city, yet at the same time he has secured results, and his knowledge has been so well grounded on the engineering part of his problem that he has been able to operate his plant most successfully not only for his Company but also in the interest of the community as is proven by the fact that he has connected a very large proportion of the people in the city who have become users of electricity in some form or another. I do not remember whether it was mentioned in the paper or not, but it has been told to me that in one of the plants that Mr. Plaice operated he was among the first to bring out the plan of milking cows electrically. I only mention that as showing the originality and skill that he has put into the problem of developing the uses of electricity in a small community. I know the difficulties of getting enough customers connected in a small place and he seems to have worked his end of it remarkably well. His connected load

is large in proportion to the population, and also the revenue derived therefrom. This has been done by the methods set forth in the paper, involving close attention, missing many meals and losing much sleep, but attending all the time to the operation of the plant for the best interests of his Company and the people of his city.

W. C. Anderson (Canton): It is pretty hard to think of anything that Mr. Plaiice did not cover in that paper; but there is one item which, I believe, in giving everything else he omitted to call attention to, which is of considerable importance; and that is the matter of public street lighting. An injury to one is the concern of all, and if one company suffers from a municipal lighting plant it is something that is of interest and concern to every electric lighting company in the state; and I believe that there is no reason, especially in view of the improved means and methods of illumination, why the streets of the different cities of the state should not be better lighted by the electric companies to a great extent that they are now or have ever been in the past. I believe it is a subject that is well worthy of a good bit more attention than has been given to it, and that the different lighting companies of the state should consider it one of their duties to light the streets, and no effort by any individual company or association should be spared in seeing that all of the cities of the state are lighted, and well lighted, by privately owned plants. I think the same aggressive methods should be used in dealing with this subject as in the handling of commercial lighting.

Clarence W. Lee (C. W. Lee & Co., N. Y.): Mr. Plaiice speaks in his paper of the educational phase as probably the most important of any of many conditions surrounding the extended sale of electricity, and the one that should be studied the closest. He says "if we educate the community, it will do the rest, and our business will increase in direct ratio with the education." From contact with the various lighting companies throughout the country in cities of varied population, I find that the central station manager has not taken advantage of the opportunities presented by the daily press, or I might say weekly press, because in towns of 3,000 to 5,000 very seldom you will find a daily. As a question of public policy, as a question of educating the people of a community to the better and more varied uses of electricity, that one point has been overlooked. In a majority of instances the central station manager upon being interrogated as to what use he makes of newspaper space replies that he uses the newspapers as a matter of policy and because he wants it on his side. Now that is a mistaken position for any central station man to take from the fact that he has a product to sell about which the majority of the people in his community should know much more than they do. He should use that space to educate the people in his community upon the varied uses of electricity. I have seen instances where space has been used, for instance, for advertising electric fans in December. That, of course, is a flagrant case. Further than display space, there are many things in the way of news matter in regard to the operation of lighting plants or street railway business that are overlooked by the local managers and in which the

public are vitally interested, and which if pointed out to them the newspaper men would be very glad to avail themselves of and assist the local manager. Often times some newspapers talk municipal ownership when they might be furnished with specific news items explaining the uses of electricity that might have no bearing on the local situation but at the same time would be of educational value and the newspaper would gladly print the same. Such articles by calling the attention of the public to the general subject of electricity are helpful to any central station.

Mr. Strickland this morning in taking up the question of the Jovian page purchased by the Buffalo General Electric Co. and the electrical contractors, jobbers and manufacturers of Buffalo, illustrated the spirit of co-operation which is animating them there. It is true that it is not possible to work out such an extensive plan as that in cities of less than 50,000 population; consequently, the central station man in a smaller town must look to his own resources. Now there are the trade papers which come to you from week to week, there are the various bulletins that are published by the manufacturers, and from these sources there may be collected items of general news interest, not strictly technical but showing the uses of new illuminants and the various applications of power, all of which can be used advantageously through the medium of your local press. It does not cost anything to get such items into the paper, and as long as you have a standing with the newspaper men it does not make any difference whether a certain newspaper is opposed to the policy of the Company or whether it may be advocating municipal ownership; whenever you show him that you are a source of news information and a help to his paper he will avail himself of it. One instance of that comes to mind. Last fall in a city not over a thousand miles from Put-in-Bay, in which there is a combination street lighting and electric power company, the general manager told me personally that he did not know the editor of a certain daily newspaper in the town although he has been there five years and during that period that paper had frequently contained attacks upon the company; yet he had not made it his business to get in touch with that newspaper man and find out what was the source of the trouble. Now that was in a city of 70,000 population. That is a situation almost unheard of; at the same time, that is an actual fact. I think that this matter of co-operation with the press could be worked out by all of you to be very helpful to the local company.

President Tait: Supplementing what Mr. Turner said about Mr. Plalce's development of a small property in Ohio, I had occasion to go to that town one time to see if all this information that I heard about it was correct; and I found that he had actually connected to his circuits over 82 per cent of the buildings in the place; in other words, that with a total of some 280 houses he had over 250 connected on his circuit, and paying him money for his service. I think there is a lesson there for every central station man to put forth renewed effort. If a man can get into a town of 1,500 and connect up almost every house in the place, why should not some of the rest of us in

towns averaging 5,000 to 150,000 try to do the same. Mr. Plalce makes the statement that "under the propaganda the addition is platted and the electric wires strung even before the streets are graded, so that when a house is built the service may be installed from the bginning." It may be a question whether the board of directors of the ordinary company would tolerate such an expenditure of money in advance of the business to that extent; but I believe that the majority of the central stations throughout Ohio are too backward in installing service for those who want it. It is certainly detrimental to install service where we are not going to get an adequate return; but I believe that occasionally it is necessary to stretch a point in order to get new business, and it is always possible to find out certainly just how much line we can afford to build, and if necessary to increase the minimum service charge for a year or two till the place grows up, with the understanding that as increasing numbers of the people connect themselves with the circuit the minimum charge will be reduced in proportion. The plan is being successfully followed, and it ought to be the means of the average central station getting most of the business and keeping the feeling of dissatisfaction down that develops when people want service and can not get it, especially when those living on a street perhaps two squares away are being served. In such a case the applicant who is turned down thinks that he is being discriminated against. He does not understand why if one man can get the service another can not. I think we should make special effort so far as we can without jeopardizing capital invested, and if the thing is carefully studied that a liberal policy will prevail. I am sure that the gentlemen here must have ideas on several other points covered by the paper that we would like to hear. We want the record complete on this paper.

W. P. Engel (Defiance): Along the line of stretching a line or two to a new customer, I have made some of those connections that might seem unwise to many. We have in Defiance a commission merchant who lives a mile and a half down the river from any connection that we have. There were six houses between his home and our main line. He wanted light out there, and he wanted it bad enough so that when I made the proposition to him that it would cost \$250.00 to run a line out there, we getting the consent of the telephone people to put our primaries as far as his residence, and that if he paid \$200.00 we would connect him up, and as each of the other houses came in we would charge them their proportion of that \$200.00 that he paid in advance, and when the entire number came in we would refund to each of them the amount paid for construction. His meter charge was about 10c a 1,000 watts, with a minimum of \$1.00 flat. In less than a year we had all six of the houses connected.

Now going back to Mr. Plalce's wonderful work at Hastings, Mich., I am operating a plant at Charlotte, Mich., which is 18 miles from him, and his work at Hastings has certainly done wonders for all the other little towns in the neighborhood. We have a very hot competition with gas, the gas company offering to place gas arcs and maintain them, at a flat rate of \$2.50 a

month, and furnishing renewal of mantles and doing all the piping, without exacting a contract to continue with them either for a year or for a month. We have had to face that competition, and yet with good electric service, promptness and efficiency we have been able to hold our own. We keep our trouble man on hand until 10 o'clock every night. If a fuse blows or a lamp is ordered in a residence a mile from the station, immediate attention is given.

As to competition with gas, in reference to the service and the price they are giving in Defiance, it is true that they will get the saloons, drug stores and other long users; but they can not touch the residences, they can not touch the better lighting. The short hour users will go to electricity in spite of anything, because the gas company will not give the short users any such privileges as we do. The price of gas is \$1.30, and we find that the majority of people are coming over to electric service. Prompt service gets the business.

At Lansing, Mich., and at other points even larger than that we find that the rates are being made as low as 1½ cents per k. w. hour and under the two-rate system as low as 8 cents for high price and 4 cents for the low price; so that I can not help but believe that the central station managers must come to the conclusion that every customer must be treated according to the service that he wants and the time of using that service, and make rates according to the service that is required. I feel that Mr. Plalce has done wonders. His success has been entirely due to his promptness and to his studying what the situation required. The rates that he has made are remarkable, and you might say no two rates alike for the customers that he furnishes, yet his success has been phenomenal.

M. E. Turner (Cleveland): In Cleveland if a person wants to get light and is located some distance from our line we have made the same kind of a proposition, that they put up the cost of the line and that we will refund it to them on a basis of a certain amount per house connected to the line. While we have done considerable of that during the past year we have no customers who are paying for their line. I think it has invariably been the case that within two or three months after a line has been furnished in that way we have connected enough parties between our main lines and the new customer to refund back the entire amount to the original connection.

President Tait: Do you refund that in money, or in future service?

M. E. Turner (Cleveland): We refund the money.

President Tait: When you ask a customer to pay \$200, \$300 or \$400 for a line and indicate to him that when additional customers get on that line his price will go down he at once becomes an automatic solicitor for the lighting company, and he loses no time in getting in other customers, because he wants to get his money back.

M. E. Turner (Cleveland): That is the way it works out. That is the reason why those people have been connected up so quickly; in fact, we have gotten the other parties connected on such line even before we had a

chance to send a bill to the first connection, and thus he never had to bill the line at all.

A. C. F. Keleher (Holophane Co.): Along the line of meeting competition, I think it is time for the central station to take the initiative and prove that they can serve the public better. You have got to prove that to people. They are all from Missouri and they want to be shown. Seeing is believing. I would offer here one suggestion, that is that the central station take their window and make its illumination perfect, and then go to dealers in the city who are displaying their goods by gas light and say to them, "Now this week we are going to let you have one of our windows to display your wares," if the proposition is accepted the man will see that so much better results can be obtained by perfect electrical illumination that you will have a pretty good chance of lining him up as a permanent user of electricity in his own window; because he will not be satisfied with gas after having seen the other. That is a scheme that has been carried out with great success in several of the larger cities and in a great many of the small cities throughout the United States.

T. D. Buckwell (Toledo): Mr. Engel spoke of a small place, and said that they got most of the residence lighting in the face of a flat rate by the gas company of \$2.50 a month. I want to say that if that was the best rate that could be obtained that I believe he could meet it, and I should think that long burning users would be just what he would want.

W. P. Engel (Toledo): Our city has a population of 5,000. We have not done any of the day lighting. They have been putting in gas arcs at \$2.50 a month. We are glad to have them get ahead of us on that figure, because they take care of the early light burning. We figure that we can hold our lighting off till almost 4:00 o'clock, excepting in December, and they take care of the long users from 2:30 p. m., sometimes 2:00 on dark days until 11:00 and 11:30 p. m. on Saturday night, and every night till 10:00 o'clock. I think that we can make the gas company lose more money on \$2.50 than we can make on any unit of lighting at a \$2.50 flat rate. If we can keep them doing it for four or five years we will be the gainers eventually. Now if I had a steam plant of an up-to-date unit and felt that I could spare the money to go into 24 hour service, I would not let them have it at a \$2.00 rate; but you have to consider the cost of operation, and where coal is costing us for ordinary run-of-mine \$2.90 a ton, and we are not running compound condensing, we must do the best we can to meet that condition. Conditions, of course, would alter that considerably; but I have found that the gas company after doing that for a year and a half are now trying to crawl out of it the best way they can and trying to put them on meter. We have not any Gem units, but we are getting their business on meter rate; and when they come back they usually stay.

Geo. C. Osborn (Harrison, N. J.): There are two central stations in the East, namely at Williamsport, Pa., and Lowell, Mass., that are taking away a large amount of gas business for window lighting by offering their customers a flat rate of \$1.25 per month for installing and maintaining a 100

watt Tungsten lamp and reflector and current furnished from dusk until midnight. After paying for the lamp this nets the central station between 6 and 7 cents per k. w. hour for long hour burning customers on business that could not be obtained in any other way.

A. C. F. Keleher (Holophane Co.): I have found that the average business man is more particular as to his window lighting, that he is more fastidious about the quality of the illumination that he gets in his window; and if the central station can line a man up by giving him satisfactory results from his window display you have the best show in the world to get his entire store. In a great many cases where we have laid out window installations in a short time we have obtained the business of the entire store.

President Tait: Anything further? If not, let us go to the next paper. Mr. E. F. Gwynn, of The Delaware Electric Light and Power Co., will favor us with a paper on "Should Central Stations Do Wiring?" Mr. Gwynn takes the affirmative of the question, and he will be followed by Mr. C. C. Custer, who I believe thinks that the central station should not do wiring.

Mr. Gwynn then read his paper as follows:

Should Central Stations Do Wiring?

BY E. F. GWYNN, Delaware Electric Light & Power Co., Delaware, Ohio.

Speaking from my own experience, and especially in smaller cities of, say fifteen thousand population and under, my answer would be: yes, central stations should do wiring and repair work; and I see no reasons why central stations should not do this class of work in larger cities, although in giving my reasons I will confine myself to the smaller cities of, say fifteen thousand population and less.

FIRST—I believe it necessary to properly SERVE and PROTECT its patrons that the central station do wiring and repair work. Cities of this size can support but one first class wiring and construction establishment and some cities cannot do this. Therefore, having but one supply house, with little or no competition, I believe lack of attention to details and of small work and repair work, together with high cost of installation, would be detrimental to the best interests of the central station.

SECOND—I believe in smaller cities of this size the central station can and would put more business on the line than any supply house could possibly do, and at the same time better satisfy the consumer. The supply house or equipment company [as you please to call it] has only one interest in dealing with the customer. That interest is THE PROFIT ON THE WORK, whereas the central station is after the consumer for the profit on the work, and is also after the consumer for the line which will be a permanent income to the central station. A few dollars may be waived in the cost of the installation, or nearly all the profit deducted, if it be found necessary, to secure a large, profitable consumer, when the central station is figuring on the work.

THIRD—I believe it to be the duty of the central station to look after all new buildings and see that the electrical installation is not being overlooked or neglected, and exert every effort to put the work on the line. In order to do this in small cities, it is almost always necessary to estimate the cost of equipment. The man who is building a residence or wiring his store wants to know how much it costs and what is best to install; the central station should be an adviser, and recommend and see, if possible, that the latest, best and most efficient method of lighting or power be installed. The central station should maintain a department for this purpose. If this is done I fail to see, after incurring all the expense and doing the missionary work, why the job should be turned over to a supply house and they take the profit on the work.

FOURTH—I believe in small cities the average citizen has more confidence in the central station and prefers to deal with them rather than with

the supply house. We find it so in our city, and presume it is so in other small cities. We have found we could do business with some of our citizens where outside wiring concerns could not touch them, and at better prices. This is certainly beneficial to the central station. We prefer to do our own engineering on power and lighting installations, and we would regret very much to turn this business over to the kind of an engineer the small supply house usually employs in cities of our size.

While our city is small, with practically no manufacturing, with cheap natural gas and a gas engine manufactory offering any terms to install their engines, yet we have practically secured all the power business for our lines. This has all been secured by satisfactory equipment and by carefully looking into and after the details of the installations.

I hear some one say, "We prefer the supply house to do this kind of work;" "We have lost money in doing wiring," or "I am too busy to attend to this class of work." In answering this I wish to ask if the supply house is doing wiring at a loss? No, of course they are not. If the supply house is making a profit on wiring, why cannot the central station do as well? It can do better. I believe the average central station manager is as good a business manager as the supply house.

It has been said if the central station does this work the consumers want it done for nothing. Of course they do; they also want light and power at the same terms: nothing. Does the central station sell light and power at a loss? No, of course you don't if you know it. I see no reason why consumers expect you to do work for nothing and I do not believe they do. They don't in our city; if they do they don't get it. The wiring department in our city has yielded a nice profit for years, and I would regret to discontinue this department on account of the profit derived from it if for nothing else. But I feel we derive as much or more benefit from the wiring department through other channels as we do from the actual profit on the business done.

Now to the manager who says, "I am too busy," "I have no time to devote to the wiring department," "I have more work now than I can attend to." To this manager I wish to say that I perhaps realize and fully appreciate as much as any one the responsibility and work that falls on the manager of the small central station: a station that can afford but one high-salaried head. The business is not large enough to stand it. I advise this manager to get into the wiring and apparatus end of the business. The profit from this department will more than pay the services of a first class assistant, one who can relieve the manager of a great many duties. The manager will then have time to devote to details and economies of his plant which he is no doubt neglecting, and by so doing running expenses will no doubt be reduced, and the dividends thereby increased, which I am sure will please the manager and make the stockholders happy.

Shall the Central Station Do Wiring?

BY C. C. CUSTER, Miami Light, Heat and Power Company, Piqua, O.

IN attempting to answer this question we are first of all confronted with the dearth of established precedent. Although the Electric Light Business is now a long established industry we find that central stations not widely apart and under conditions which we cannot believe to be varied to any considerable extent, adopt widely different policies. No one has as yet formulated a code of ethics which has been formally accepted as exactly outlining the field of activities, defining the duties, and placing the responsibilities of the management of a public service corporation. However, from the stand-point of the stockholder, it has been asserted that the Central Station manager "must combine with his technical knowledge, the energy of a locomotive, the activity of the Devil, the sleepless vigilance of a Cerberus, the manners of a courtier, and the long-suffering patience of a Job." Among other things he must keep track of the operating details and know what all his men are doing, must keep in touch with all his customers, and lend a willing ear to all real or fancied grievances, must levy and collect the monthly stipend from consumers, make them feel they are getting value received and make them love him for it.

In the last few years in addition to the foregoing he has had to become proficient in new business-getting methods, has learned to blow his own horn by advertising, and pose before his customers as an illuminating engineer. His duties have become so varied and multitudinous as might well be termed an example of the "strenuous life."

When, however, some one says the central station should do wiring, I feel that the question is a debatable one. I think in this age of specialization the function of the central station is primarily the generation and sale of current and all its energies should be expended along these lines. The electric light business is a peculiar business in that there is only a local and limited market for the commodity manufactured and in order to achieve the greatest possible returns it is necessary to develop the market to its fullest extent. Anything affecting the development of this local market is of course of vital interest to the Central Station. It is to the Central Station's interest that house wiring be well done and the wiring business pushed, but this does not necessarily mean that the work must be done by the central station nor that when so done it will be better wiring. It seems to me that this is a field where the central station should be a co-operator instead of a participator. I think it is possible to get good wiring done by private contractors, and such contractors should have the moral support and co-operation of the central station. When sure of this support I believe it is generally possible to get a sufficient number of responsible private wiremen to enter the field.

There are several ways by which the central station can influence the

character of the wiring: 1st, by influence with the wireman himself, and inspection of his work when it is ready to connect up; second, by getting the underwriter's supervision and inspection on as many jobs as possible; third, by furnishing to owners or architects plans and specifications free of charge for the larger and more pretentious installations. An effective way of getting in touch with the builder is to keep a record of the building permits as taken out, and mail to each applicant for a permit a circular letter setting forth the desirability of having his house wired for electricity, offering the services of the company's illuminating engineer free of charge in an advisory capacity, and perchance a blank wiring specification is enclosed. By properly getting in touch with a prospective customer at this stage it is possible to gain his good will and make a friend of him before he becomes a consumer, in fact you can do a great deal to disabuse his mind of the usual conception many people have that the electric light company is a grasping corporation trying to make a profit off them at every turn.

When the electric light company does the wiring there is a tendency on the part of a great many people to blame the company for every little thing that gets out of fix on the premises as a switch getting out of order for instance and they will expect the company to make good all such defects for an unreasonable length of time after the wiring job is finished. I think these considerations make it unwise for the lighting company to be responsible for the wiring and should have as few points of possible difference with the consumer as possible.

When my wife gets provoked at the groceryman around the corner she promptly changes her custom elsewhere. However in a month or two I find her trading again at the same old stand.

The Electric light consumer however generally has no such relief, grievances become accumulative in effect and this is what makes monopolies so odious in the minds of some otherwise broadminded people.

I would not do wiring for the reason that I believe the time and energy could be more profitably employed otherwise, for instance in new business getting. The profit in wiring is a transient profit while if you can sell thirty washing machine motors, and fifty electric irons, or place a few power motors to build up a day load, you will be getting on business that in spite of its looking small at first will produce a dividend every month afterward.

In regard to getting old buildings wired, I know of a company that proceeds after the following manner:—

The company consults all the local wiremen who agree to a certain scale of prices. The company then advertises, "A Seven Room House Wired for Forty Dollars," and solicits the business, arranges the specifications, submits cuts of the rather cheap fixtures to be used in this case. After the preliminaries are arranged the customer is referred to a list of wiremen any one of whom will attempt the work at the stated price. In this manner the company may co-operate with the wiremen and put into effect the creed:—

EVERYBODY ALTOGETHER, ALL THE TIME, FOR EVERYTHING ELECTRICAL.

Discussion.

President Tait: This subject came up for discussion last year at Toledo, and there was so much excitement about it that it was deemed wise to continue it at this convention in hopes of having it settled for all time. (?) I hope the discussion today will be sufficiently full that we will be able to absolutely know whether we should do wiring or not.

W. P. Engel (Defiance): My opinion is very decided that a central station, large or small, shall do wiring and shall have a trouble-man that will look after every detail of residence or factory; and in that way give more prompt service and eliminate complaints that this, that or the other is going wrong.

President Tait: Do you mean that repairs shall be furnished without expense to the consumer?

W. P. Engel (Defiance): No, the consumer shall pay for every renewal and every supply part that is used for repairs, but no time to be charged in the bill; the man's work of making such repairs or wiring any part of the installation shall be gratis; but any repair part, such as a switch, socket, or anything of that kind shall be paid for by the consumer.

A Member: I would like to ask the last speaker a question. I frequently run up against the proposition where a cord installation will get old and has to be renewed. I would ask whether he would renew that simply by charging the customer for the cord?

W. P. Engel (Defiance): In the case of an old cord which has worn out by use we will charge the party for the time and expense of replacing the cord; that is new work; but in the case of a short circuit that is evidently caused by dirt or the wires getting together, etc., that has a tendency to throw blame on the Company which we know they do not deserve always. but at the same time the consumer lays the blame to us, and in such cases we leave it to the trouble-man to use his judgment in making out the bill. If he thinks the customer ought to pay for it, the bill is made out accordingly; but on the other hand, if he finds the party is disgruntled and a complaining character we dispose of the matter according to the circumstances of the case. We would of course prefer to supply him the cord at his own cost, and let him put it in himself.

F. D. Elwell (Sidney): I think that in a great many cases the question of whether the central station should do the wiring depends on the sentiment existing in the community towards the electric lighting company. If it is local capital and the people are friendly towards the concern, it may be all right to do the wiring; then again we all know that many electric light corporations in the past have not followed a liberal and broad-minded policy, in other words, have not been angelic; and so in some cases their successors in the business have to bear the brunt of their misdeeds and undertake the task of winning back the friendship of the community which has been forfeited by a wrong policy. In that case I think every pains should be taken to avoid

unnecessary friction, and in such case I should say for myself, better not do any wiring, but leave it to the contractors. It all depends on local conditions.

W. M. Adams (Elyria): I think last year I made a statement that about twenty-five years ago the artificial gas companies were afraid they were going to be knocked out of business, and they concluded to go into the plumbing business, etc., offering to put in services from the mains clear into the house, and selling gas stoves at cost in order to sell gas. The result was that in a few years they were disposing of 30 per cent of their entire gas output for heating and cooking. Why should not the electric companies adopt the same policy with regard to electric wiring? It brings you in touch with the people, and you can do it and still make it profitable. We have a tremendous amount of trouble with contractors. I believe that every central station man should wire if located in a town of 15,000 and under; although I do not do it myself—but I would like to.

E. T. Sellg (Mt. Vernon): At the convention last year I expressed myself in favor of central stations getting out of the wiring business and turning it over to the contractors; and a year's further observation of this matter has only tended to make me more convinced that that is the right view to take of it. Every contractor you have in your city will then be a booster for your business. They cannot make a living without your profiting also. The small amount of electrical construction that has no bearing on the electric light or power end would not be any inducement to keep a contractor in business. I have in mind one instance of a town I have visited where the management is not what we term progressive. A small factory there wanted a motor requiring perhaps 25 or 30 horse-power. The central station manager did not seem to realize the importance of getting the business, and turned down the application. There is a good live contractor there who did not want to see the business get away from him, and he got right after the matter and finally succeeded in proposing a plan to the central station by which he convinced them that it would pay them to run out and connect up. If it had not been for this contractor being interested the company would have lost every bit of that revenue. They have as I learn realized quite a handsome return on the installation made. That was simply one instance where the contractor worked hard not only to benefit himself in the first instance but to materially benefit the central station in the outcome in the very face of the opposition or indifference of the central station management. I think that central station sees it differently now; but a great many rather unprogressive central stations need the stimulus of a good live contractor to boost the new business.

W. C. Anderson (Canton): Originally nearly all the central stations had to do wiring; as time went on and business grew it got to a point where competition for the wiring grew up from contractors. That placed the Company in a rather awkward position because it made the contractors who should be co-operating with us rather antagonistic than otherwise. The contractors then saw their interest rather in getting isolated plants in and were more inclined to encourage complaints against the company from slight causes. I believe

that in a small city where, as one of the gentlemen expressed it, there is only room for one wiring concern, that concern should be the Company; but as soon as it gets to the point where there is competition in that field, I am strongly convinced that the company should keep out of that business, and what free wiring it is necessary to make that it employ the local contractors to do. We are most of us spending a lot of money to further new business work, and if we want to get it probably the best solicitor that we can employ is a wiring contractor; and the relations should be so maintained that every wiring contractor is endeavoring to sell motors instead of selling isolated plants. In making trial installations it will probably be almost as cheap, if not altogether as cheap, for the company to have it done. They are in position to get special rates; and on the whole I think that after we grow up to a certain point it is almost essential that we turn that part of the business over to the people to whom it properly belongs.

Arthur J. Howard (Medina, N. Y.): I do not feel that I should take up any time in this convention, because I do not belong to the State of Ohio. I have been for some thirteen years connected with a plant in a city of 5,000; when we first started that plant we started to do our own wiring, and we followed that plan for about six or seven years. About five years ago I had two young men that worked for the company doing wiring, and we made an arrangement with them that we would turn over the wiring business to them, and started them off in that field. Since then we have had nothing but trouble from start to finish. It has been impossible to get any wiring done satisfactorily, and we have had more complaints from our customers than we ever had before. We even went to another city and got two other young men to come there and go into business; they stayed a month; the fellows that were there determined to do the work, and did it cheaply, but not as it should be done. In one case they got the electric wiring for lighting all mixed up with the annunciator service in the house. The laws are different in New York state from what they are here, and if any damage results from defective insulation or wiring and a fire occurs therefrom the lighting company can be held responsible in damages. That is the reason why we ceased to do wiring. We have a new idea now, and that is, to organize a small stock company to be controlled by the electric lighting company, and perhaps have some of its officers in joint offices in the electric light company. We feel that perhaps in that way we can avoid some of the troubles that we have been having.

President Tait: Do I understand that we are to believe that in a station of from 8,000 to 10,000 population the central station should do the wiring, and in central stations located in cities of over that population they should not do wiring? That seems to be about the average opinion that has been advanced here today. (A Voice: "Take a vote on it!") I would like to see a vote on it; I have been very much confused on that, I do not know whether central stations should, or should not do wiring. I would like to have the central stations tell me which is the right thing to do; if you will vote for or against it, we will try and find out.

M. E. Turner (Cleveland): Before you take a vote, I would like to bring out a point on wiring which perhaps may be worked out in other places even where the central stations are much smaller. At the present time, in Cleveland it relates entirely to house wiring. Some two years ago we started in Cleveland having the wiring done by certain contractors, but the consumer paying for same on the installment plan. As at first worked out the plan did not prove entirely satisfactory, although about 500 houses were wired the first year; and then we adopted the plan now in force which seems to be more successful. 1,000 or more houses have been wired under this plan. It is a little cumbersome in its details, but I think accomplishes results and keeps the central station from incurring any liability or responsibility, either legal or moral. We solicit the wiring of houses, believing that we can do best for all concerned. We tried having the soliciting done exclusively by the supply houses but the number obtained was not satisfactory; so we do the soliciting. A flat price is offered for the wiring per outlet, so that the solicitor is in position to make a complete estimate for the wiring of any old house. The wiring contract when obtained is turned over to any good wiring contractor who will work under the plan. He agrees to take any houses that we turn over to him whether he is going to make or lose money on them, and his charge for the wiring cannot exceed that set forth in our printed schedule of flat rates of so much per outlet. The company credits the consumer on his electric light bill 15 per cent of the cost of wiring and fixtures up to a total of \$15 rebate on a total bill not exceeding \$100 worth of fixtures and wiring. We have so arranged with the fixture house that they are glad to sell fixtures also on the installment plan of payment. This plan has been working out very well in the past year, and the incentive for the wireman wiring houses to do soliciting is that he turns the contracts over for the wiring of houses on a prorata basis as to the number that they turn over to us that they have solicited; so we figure upon turning to each wiring house that works under this plan at least one house for every one that they turn in to us. That means that their expense for soliciting per house is cut in half. We also pay the wiring house a bonus for each house that is turned in to us by them, and also help with his soliciting expense, so that the cost of soliciting to the supply house is small, although we control our line of soliciting to these houses and we do make the bulk of the contracts, our solicitors actually making the estimates at the time they first see the party whose wiring is to be done. Now the cumbersome part of it is that in order to keep the company out of it entirely in any moral or legal way we have the customer sign an application card in which it is stated definitely that he understands that the Illuminating Company does no wiring, and that his house is being wired by the wiring contractor. Those are not the exact words employed but that is the intent. In addition to that a post-card is mailed to the consumer when the contract is brought into the office of the Illuminating Company, in which postal there is no reference to the Illuminating Company, but the card simply states that the wiring contract has been accepted by the undersigned (Naming the wiring contractor who is

to do it), and that upon receipt of the return postal the wiring will be immediately started. That return postal card is addressed to the wiring contractor, which ever one is to get the contract; and as soon as the contractor receives the return postal card he delivers it to the office of the Illuminating Company and we install the service, and he immediately proceeds with the installation of the wiring. In that way, as I say, there has been some 1,000 or 1,200 houses wired, every one of which is along the line of our mains, and the company has incurred no legal or moral responsibility in it. Every customer understands that his wiring is being done by a certain wiring contractor.

President Tait: Mr. Turner, would you like to make any announcement to the Association at this time?

M. E. Turner (Cleveland): I apologize for breaking into the business session with this, but it is necessary to make certain arrangements in regard to the banquet tomorrow night that have to be made at this time. In the first place, with regard to entertainment, I want to say, that today is not the big day. I have heard some people say that Wednesday is the "big day," with the idea, I suppose, that they will go home tomorrow morning. Wednesday is purposely a much better, bigger day than Tuesday, but not as big as Thursday has been planned, so as to keep you here. The entertainment for this afternoon is, that immediately upon adjournment of the session here, which I believe is scheduled for 3:30, we will go down to the bathing beach. Some say they cannot swim, and for the benefit of those I will say that the water at the beach is only up to your waist for a matter of 200 or 300 feet, and it is one of the best bathing beaches on Lake Erie, and just beyond there is a remarkable spring board, at least there was last summer, and I guess it is there yet; so we want the convention with their ladies to go to the bathing beach at 3:30; whether they go in, or not, I think they will enjoy watching those in.

This evening between eight and eight-thirty we are to be entertained by a professional colored quartette that has been brought over from Cleveland. I cannot personally speak for their qualities as entertainers, but from the information I have collected in Cleveland they are the best entertainers in that line of any that can be found in that city; so I think they will be able to entertain you very well; and in connection with that, it is the intention about every half hour to have an informal dance. The music will play a dance about once every half hour, so that we can have an informal dance; and every other half hour this chorus that has been practicing together are going to give a song. Some of these will be popular songs, and the idea is to have every one join in with them. We want everybody to have a good time. The only way to have it is to have everybody join in and see that he has a good time himself. Bridge whist is scheduled but it is not a feature of this evening's entertainment. There will be cards furnished for any who care to play, but it is not a part of the regular entertainment. The regular card game comes tomorrow. This dance tonight is understood to be informal, so that if any of the ladies wish to know about wearing evening dress, or the men, I would state that it is scheduled to be an informal entertainment and dance, most of the enter-

tainment as I say, to be furnished by this professional quartette; but we are all expected to take part and make our own entertainment in the way of dancing and singing.

The entertainment for tomorrow is intended to be made somewhat better than today. There will be card parties for the ladies, and in the afternoon there will be swimming again; and in the evening about 7:30, the exact time to be scheduled during the meeting tomorrow, we will hold a banquet probably in the dining room. This banquet will be paid for by the Association, and there are some dozen of the men who have very kindly agreed to take part in a vaudeville performance during the course of this banquet. The entire entertainment will probably run from about 7:30 to 11:30. I think those who are to take part in the entertainment are on the program as the "Official Amusers"; and I think it will be worth your while to stay to the banquet and also to this vaudeville entertainment which will take place during the latter half of the banquet; and the other entertainment will be supplemented by a professional reader that we have secured from Toledo, who, I understand is very clever in her way. It is hoped to warm the convention up by having everybody join in the popular songs that the chorus is going to be ready with. The tickets will be given for this banquet tomorrow morning, and every one here should make application for himself and ladies for tickets before tomorrow noon, because we have to arrange with the hotel management for the exact number of people that will attend the banquet. There are some 25 or 30 delegates to come in on this noon's boat, perhaps more; so there will be a total of about 210 or 225 people, I think, in attendance; and if we are to have that many we want to arrange for them; so please everybody tomorrow morning or some time before noon that desires to attend this banquet and vaudeville performance, see Mr. Gaskill and get your tickets for it.

W. P. Engel (Defiance): Going back to the question of house wiring, and whether central stations shall do it or not Mr. Turner's explanation of the method that he has employed and of the central station doing the soliciting may be well enough in its place and in the larger cities of Cleveland, Toledo, Chicago and such places as those, those methods may work out; but I do not see how it is possible even with the larger cities to gain anything by doing the soliciting and then turning it over to contractors, inasmuch as that means an additional cost for each house connected for soliciting and for inspection of the wiring when done, and also in order to get this contractor to work in harmony with you. My theory is that a large city in doing that will run up against just troubles and just as many people in the wiring and construction business that will take advantage or try to take advantage of the central stations as they would if they went out to do the soliciting business themselves. One disadvantage that I would see in turning it over to the contractors themselves is that they will go out on the outskirts away from the mains of the central station and induce parties to wire their houses either on the cash basis or on a payment basis who will be so far away from the lines that it will not be profitable for the central station to reach them; and if you do not take them on the solicitor will be

sore because he thought he saw a profit in it for him. On the other hand, if the central station men do the soliciting they are instructed to stay within a certain distance of the mains and not go beyond. For that reason I believe the central station manager can afford to hire a solicitor that is capable of judging where he can take new business at a profit to the central station, and what distance beyond the established mains he can safely go. So far as people complaining that you are a grasping corporation you cannot avoid that any way. The public in my experience, no matter what the existing sentiment may be toward the company as a result of former mismanagement, must be won over to be on your side. This must be done either by personal solicitation or through the assistance of the press, pamphlets or booklets, or the manager must secure capable assistants who can produce that impression on consumers.

J. W. Beam (Cleveland): In the case of a house being wired to which we have to extend our lines even to the extent of one pole, we do not give the consumer the rebate of fifteen per cent in current on his bills. Neither do we give the small cash bonus to the wiring contractor who solicited the business; therefore, they have no especial object in getting people away from our lines to wire up.

W. C. Anderson (Canton): We turn the wiring over to certain of our former employees. So far as any fire risk falling on us, all the work is inspected by insurance authorities, and they make a very thorough inspection; and that of course relieves us or the wiring contractor either, for that matter; and as far as having troubles, we have had probably some little troubles both before and after we stopped wiring; but we have gotten more business and at less trouble since we stopped wiring, because we have had all the wiring contractors assisting us, and thus the doing away of the wiring department has proved an unqualified success.

President Tait: The next paper with which we will be favored is by Mr. J. S. Codman, of Boston, Mass., on "Illuminating Engineering."

Which was read by Mr. Codman, as follows:

Illuminating Engineering.

BY J. S. CODMAN, Boston, Massachusetts.

There appears to be every reason to expect a great expansion of the electrical business in the near future. Not only may we expect an accelerating rate of increase in the use of electricity for power, heating and cooking, but we are also on the eve of a great era of expansion in the use of electricity for lighting. Electric lighting is today the most important part of the central station business, but its supremacy has been threatened, and not long ago, I believe, there were a number of us who expected to see the power business pass ahead of it in the near future. We must revise our opinions now, however, and admit that electric lighting seems destined to maintain for many years to come its supremacy as the most important part of the central station business.

This change in the prospects of electric lighting is of course due directly to the reduction in its cost brought about by the advent of high efficiency lamps, especially the tungsten.

This reduction in cost was at first feared by many central station managers, who thought that the income of the stations might thereby be reduced, but now it is pretty generally felt that it will give a tremendous stimulus to the electric lighting business and will react favorably on the power, heating and cooking business as well. I venture to say that you have nothing to fear and everything to gain from a reduction in the cost of electric light, heat or power, whether as the result of a reduction in the cost of producing electric energy or as the result of improved processes in the transformation of electric energy into light, heat and power. A reduction in the cost of producing electric energy benefits you directly. A reduction in the cost of transforming electric energy into light, heat and power directly benefits your customers, but most assuredly does it also benefit you indirectly by opening up increased opportunities for business.

Electricity has many worlds yet to conquer, and when it can compete on equal terms as regards cost, its complete victory will be assured. Let us all, therefore, central station men and manufacturers, get together and do our utmost toward bringing down the cost of electricity. Let the manufacturers strive to obtain in engines, dynamos and other generating apparatus, the highest efficiency and reliability, and let the central men employ such apparatus to the greatest advantage not only by handling it skillfully, but by supplying it with a proper load obtained by an energetic "new business" department and by a well designed system of rates. Let the manufacturers also continue to

strive to produce apparatus of the highest efficiency for transforming electric energy into light, heat and power, and let the central station men see that this also is used to the greatest advantage, even though, unlike the generating apparatus, in many cases it is not under their direct control. In other words let the central station men co-operate with their customers so that the customers' installations may be of the highest efficiency.

In co-operation with customers there is, at least in the lighting field, a great opportunity to bring down the cost, since the waste by customers not only in converting electric energy into light, but also in the use of the light itself is something prodigious. This continual waste unrealized by customers leads to the impression that electric lighting is more expensive than is actually the case, with the result that many are afraid even to try it and the growth of the business is therefore stunted.

One of the principle objects of the science of Illuminating Engineering is to prevent or at least check this great waste, and some knowledge of its principles is therefore of great value to those connected with the central station business.

To be a skilled illuminating engineer, however, well versed in all the complex mathematics of the subject, is not necessary for the accomplishment of great results. Many of the ways of wasting electricity or light are perfectly obvious and can be easily remedied either by adopting certain policies, or by a campaign of education among the customers.

For example, how much electricity is wasted by customers through the use of cheap lamps of low efficiency, and by the use of lamps after they have reached the end of their useful life? This can best be remedied by the adoption of the wise policy of furnishing lamp renewals to customers either free, or at least at less than the market price, and by the offering of these renewals at stated intervals. This policy enables the company to supply its customers with lamps of high efficiency, and to a great extent prevents them from being used too long.

Another prolific cause of waste against which customers should be warned is the use of dirty lamps. From 20 to 30 per cent of the light may easily be wasted in this manner and such a condition of affairs is very detrimental to the interests of the central station.

The use of an unnecessary amount of light is still another form of waste. This is most common in residences where 16 candle power lamps are often put in every socket, as the result of the policy of not encouraging customers to use lamps of less candle power. This practice may have a most unfortunate effect leading customers to use 16 candle power lamps in many places where 8, 4 or even 2 candle power lamps might give all the light needed. And this unnecessary addition to the bill will deter the customers from using lamps of higher candle power than sixteen in those places where such lamps are really needed. The result is too much light in some places and not enough in others, and again electric lighting appears to be inefficient and expensive. Of

course, customers must not be urged to be penurious in their use of light. They should have abundant light for their purposes, but more than is needed is undesirable. Bills commensurate with the actual results obtained by the customers, will be a source of satisfaction and it should be remembered also that low bills for lighting will lead to the use of electricity for other purposes likely to have a better effect on the station load factor.

Another cause of waste, also most common in residences, is the failure to make it easy to turn lights on and off. Lights are sure to be left burning, if otherwise it is necessary to grope about in the dark. Here is an opportunity to impress upon our architects and customers the desirability of plenty of switching properly located. Often the money spent in unnecessarily elaborate fixtures might be spent on switches and extra lighting outlets to the great ultimate satisfaction of the customer.

The above described ways in which electricity and light are wasted are, as already stated, obvious and to overcome them requires no technical training.

There are other ways in which light is wasted, however, which are not so obvious, and to overcome which some knowledge of illuminating engineering principles is necessary. First, there is the practise, far too common among us, of blinding ourselves with dazzling lights directly in the line of vision. The resultant glare makes it impossible to see well, but the true cause of the trouble is often not appreciated and the demand is therefore for increased light which only increases the glare and is consequently wasteful. The use of bare incandescent lamps is a form of waste of a particularly unfortunate character, for not only does the customer fail to get the best illumination for the minimum amount of money spent, but also the practise directly injures the business by giving electric lighting the reputation of being bad for the eyes. As a rule the lights themselves are not what we want to see, but the illumination due to them. If possible, therefore, the lights should be put out of the line of vision, but if this is not practicable satisfactory results can be obtained if their brilliancy is kept down. By low brilliancy, however, is not meant necessarily low candle power. The brilliancy of a light source depends not on the total quantity of light emitted, but on the quantity of light emitted in proportion to the area of the surface presented to the eye. For example a bare 16 candle power lamp gives about the same amount of light as the ordinary flat flame gas burner taking 5 cubic feet per hour, but the bare incandescent is by far the more brilliant of the two. The area of filament presented to the eye is only a small fraction of a square inch, while the gas flame has an area of perhaps three or four square inches. In fact the flat flame gas burner, and the candle are examples of light sources of low brilliancy, and the possession of this desirable quality of low brilliancy undoubtedly accounts to a considerable extent for the stubborn way in which these light sources continue to hold a market, in spite of the advent of lamps of much greater economy. The brilliancy of the incandescent lamp, however, can be readily reduced by enclosing it in a properly designed diffusing globe of opal ground or prismatic glassware. Globes

can be obtained which will absolutely conceal the filament of the lamp and will make the light appear to come evenly from the whole surface of the globe itself, thereby, increasing the area of the light source and reducing the brilliancy. At the same time, the actual loss of light is trifling as compared with the great reduction in brilliancy.

The brilliancy of the tungsten lamp is far greater even than that of the old carbon lamp and in my opinion the use of it unshaded is almost criminal. It is most commonly used to-day with a deep holophane reflector and the tip of the lamp frosted, so that the filament itself is not seen. The reflector and frosting cause some loss of light, of course, but this loss is absolutely negligible when the great reduction in brilliancy is taken into consideration together with the fact that an actual average increase of light of $13\frac{1}{2}$ per cent is obtained in all directions below the horizontal.

And this last statement leads us to the consideration of still another cause of great waste of light, namely that due to the thoughtless and indiscriminate use of globes and reflectors. There are two ways in which this may occur, first by the actual absorption of the light and second by the failure to direct it where it is needed. Well designed globes and reflectors are exceedingly valuable devices both for softening the light, that is for reducing its brilliancy, and for distributing it in the desired directions. They should, however, be used intelligently. If used without knowledge of their effect they are often worse than useless.

Not very many years ago the illuminating engineer who wished to know about the effect of different reflectors had to make the test himself, or guess at the results. To-day a number of the prominent manufacturers publish photometric curves of globes and reflectors used with different light sources and in many cases the tests from which these curves are derived are not made by the manufacturers themselves, but by outside impartial experts who make a business of accurate testing. These curves are readily obtainable and in many cases the knowledge obtained thereby, together with a fair working knowledge of the principles of good illumination, is all that is needed in order to lay out lighting installations in a very satisfactory manner.

In the case of very large, or complicated problems, it is generally advisable to call in the services of a consulting illuminating engineer, if there is none such connected with the company, but for most cases the manager of the company, or one or more of the solicitors can acquire all the necessary information.

It has been the object of this paper to call attention to the great waste of electricity and light by the customers of the electric light companies; to impress upon you gentlemen the desirability of co-operating with your customers to check this waste; and to urge upon you the importance of a knowledge of the fundamental principals of good illumination.

I have not felt that it was within the scope of this paper to discuss any of

the technicalities of illuminating engineering nor to make any general statement of the principles of good illumination. Such information can be found in the text books, in the technical press, especially the "Illuminating Engineer," and in the publications of the engineering departments of some of the manufacturers.

There is one question, however, which I wish to take up in some detail as it is one that should be understood by all interested in commercial lighting. This is the question of the amount of illumination required for different purposes. For instance we must have a certain amount of illumination on the page in order to read ordinary print with comfort. To do grafting or fine sewing somewhat more illumination is required. Again a show window must have more illumination than the interior of the store.

Is there not some way by which we can express in simple terms the amount of illumination required? There is a way, but before stating it, I want to make clear just what is meant by illumination. Illumination is not light, but the effect of light. A candle gives a certain amount of light no matter where it is placed, but the illumination obtained from the candle, on the pages of a book for example, depends on the distance of the page from the candle and on the angle at which the light strikes the page. We can get the same illumination on our book from a candle as we can from a 16 candle-power lamp, but to do so we shall, of course, have to hold the book much nearer. Is there not then some unit in terms of which we can express illumination, just as we use candle power to express intensity of light, and is there not also some way of getting an idea of the value of this unit? We all certainly have some idea of the value of the candle-power. If a lamp is said to give a light of 100 C. P. we think of it as a light equal to 100 candles, and we feel that we grasp what is meant. Why then may we not also have a unit of illumination and an equally concrete idea of what is meant by it? Engineers have used for a long time a unit of illumination called the foot candle, and if all those interested in commercial lighting could get an idea of the value of this unit it would be a most excellent thing. If a store keeper could say to his illuminating engineer: "I want so many foot-candles of illumination on my goods and no more than that amount is needed, the engineer could then go ahead and get it for him. At present one of the greatest difficulties with which the illuminating engineer has to contend is lack of knowledge of what illumination his client would like to have, and his client is not in a position to tell him having no standard to go by. Let me therefore, explain to you what is meant by a foot candle. If a point is at a distance of one foot from a candle, the illumination at the point has a certain definite value and this value is one foot-candle. An idea of this amount of illumination can readily be obtained by holding some printed sheet at a distance of one foot from the flame of the candle and at right angles to the direction and excluding other light. It will be found that it is an illumination not very great but still amply sufficient to read ordinary print with comfort.

For other purposes very different amounts of illumination may be required.

ed. For example, the minimum illumination on the ground for street lighting half way between posts is as low as 0.03 of a foot candle, while for show windows an illumination of ten to twenty foot candles is often used. For drafting about five foot candles is satisfactory, while on the counters of a dry goods store the illumination should be from two to four foot candles.

My excuse for the above discussion of a question, probably by most of you considered technical, is that, in my opinion, it is a question which ought not to be so considered. Not only the engineer, but everyone interested in lighting should understand the difference between light and illumination, between the candle-power and the foot candle and should also have some concrete idea of the value of both these units.

And now returning again to the main question let me in closing once again urge the importance of checking waste by customers. The extra income obtained as the result of such waste is of the same nature as the saving in expense obtained by giving poor service. Both are of only temporary advantage, and either will ultimately be followed by a loss of a much greater amount.

Discussion.

President Tait: Gentlemen, this is a most excellent paper. I know everybody here is interested in the subject of illuminating engineering. We need it in our business. I want to have a full discussion of the paper if possible. I will call on Prof. Caldwell, of the Ohio State University, to open the discussion, if he will,

Prof. F. C. Caldwell (O. S. U.): Mr. Chairman and Gentlemen, one of the most interesting things in connection with the electric lighting business during the last few years has been the growth of interest in illuminating engineering. It is highly important that we should have our lights well placed in order to get the best results from them, and this was just as true twenty years ago as in the past three or four years; but somehow co-incident about with the coming of the higher efficiency lamps there came a great development of interest in illuminating engineering; the application of the light, the establishment of the Illuminating Society, the starting of one or two periodicals along that line, publications by manufacturers, etc., have done more to educate electrical industries in the science of illumination during the past three years than had been done during the whole preceding history of electric lighting. Of course the general subject of illumination is not a special electrical or electrical engineering subject. It is just as important to the gas engineer or to any one else who is connected with lighting, the architect, for instance; but the fact remains that illuminating engineering has been almost entirely developed by electrical engineering. This has been largely due to the fact that electric light has lent itself so particularly well to the designer in this direction. With the gas burner and its predecessors it was necessary to place the burner or lamp in certain locations on account of its open flame and the fact that it was liable to set fire to things, etc.; whereas the incandescent lamp could be placed in almost any location where it would do the most good. The great importance of it is coming to be realized more than it ever has been before. We are coming to realize that during the past years we have strained every nerve to increase the efficiency of our generating plant by 3, 4 or 5 per cent, while our customers in using their light were wasting 30, 40 or 50 per cent.

Really, the central station man is dealing in light rather than in current, that is, so far as the lighting part of his business is concerned. The consumer does not know anything about current, he is not interested in current, he does not want current. What he wants is light, and that is what the central station man sells him—light. Now it is very inconvenient to measure light, so we measure what we sell in the form of current; but it really is light that the man wants and pays for. We have been letting him waste too much of it, and we are now beginning to appreciate the fact that it is to our mutual interest to teach him how to use the light so that he will get the best efficiency out of that end of the line as well as the high efficiency that we obtain in the power house.

The need for education is certainly very great, not only amongst users

of light, but particularly amongst those who have the locating of the light in the house, the architects, etc. It is very important that the central station manager should keep the architect in mind. Architects feel themselves competent to do anything, and amongst other things to lay out any kind of a system of lighting, whereas as a general thing they do not know much of anything about it, and they do not take the trouble to learn but just go ahead and put the lights in any old way. So that it seems to me it is largely up to the central station people to keep an eye on the architects and see that in placing the lights they do it in such a way that the owners of buildings who will be the customers of the lighting company shall get the best good out of the lamp and the most return for their money. There is no class of people who have a better opportunity to realize the great inertia inherent in human nature than central station men. It is felt in every direction, but perhaps it comes up more prominently in illumination than any other line.

The candle was the predecessor of our older forms of illumination. The oil lamps took the place of the candle, and took the form of the candle-stick. When the gas fixture came along it could not exactly take the form of the ordinary portable oil lamp, but it took the form of the supported oil lamp, and retained on the stem the enlargement which used to be the oil reservoir of the ordinary lamp, then the electric fixture came along, and that took the same form that the gas fixture had, with the tendency, for instance, to make the lamp point upward instead of downward as it ought to do. So we have to suffer from the inertia of human nature and go through the process of educating people to the fact that the electric lamp can be used anywhere it will do the most good, that we have not got to put it where they used to put the gas fixture. In the kitchen, for instance, we are not compelled to put the electric light in the middle of the ceiling as they used to put the gas fixture, but can have it where it will shine on the table or cook stove and give the most light where it is most needed. These are points that people generally and architects in particular have not come to realize at all. It seems to be up to us to educate them along these lines.

There were several points in the paper that I want to emphasize. One of the most important is this point in regard to the waste due to dirty globes on incandescents. Especially is this true in places where dirt is most likely to accumulate. For instance, if you go through many machine shops you will find the incandescent lamp covered with greas and dirt so that it is doubtful if 25 per cent of the light sometimes gets through. Education along that line is very important.

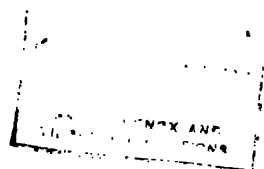
With regard to the use of an unnecessary amount of light the Hy-lo lamp may very well be mentioned as something which comparatively few people realize the value of—an electric lamp which we can turn down. I think some station men are opposed to it on the ground that when the lamp is turned down there is not enough current passing to make the meter register, and people are liable to have the light without paying for it. The proper point of view is that the Hy-lo lamp is such a great convenience to the customer

that the station can very well afford to lose the small fraction of light they lose when the Hy-lo is burned without registering on the meter through the night.

With regard to the matter of convenient switches, I have recently built myself a house which I guess has about as much wiring as any house of its size in Columbus. Amongst other things I have put in a number of chandelier switches arranging them to operate lights in different parts of the room instead of on the chandelier, so that the first quarter turn will light the lights that you have the most occasion to use; the next quarter turn will light some other lights that you do not use so often, etc., so that in that way I can operate all the lights in my room for ordinary use, and then when I want more light can turn the switch another quarter. I have found it very convenient. It makes the lighting a little more expensive, but not very much, and it is a distinct convenience. The point with regard to the use of the naked filament is certainly one which can not be too much emphasized. A naked filament should never be allowed in any situation where it comes anywhere near the level of the eye. It defeats its own purpose in the matter of giving light by causing the pupil of the eye to contract so that the light does not get in, and consequently the object looked at appears darker even than if the light were not there to cause that contraction. Besides that, it does hurt the eye and produces an unpleasant effect. This I think needs special emphasis in connection with show windows. There is a strong feeling in a good many quarters that what is wanted in show windows is the strongest light that will attract the eye. I believe a much better effect is obtained in a show window where the lights do not show and where the object of the light is to light up the goods which the merchant has to display and advertise. This is perhaps rather trite, but it is certainly something that most people need education on. You see many windows where the thing that attracts your attention is not the goods but the rows of lights around the edges which make a good advertisement for incandescent lamps rather than the goods which the merchant has to dispose of.

President Tait: Anything further on this paper? If not, let us go on to the next paper, the "Report of Experience of Central Stations With Tungsten Lamps," which has been collated and edited by Secretary Gaskill, and will be read by him.

The report follows:





D. L. GASKILL, Secretary and Treasurer,
GREENVILLE, OHIO.

Report on Experience of Central Stations With Tungsten Lamps

EDITED BY
D. L. GASKILL, SECRETARY

About April 1st, 1908, it was decided by the President of the association to procure, if possible, the experience of the central stations belonging to the association with the tungsten lamp. And at his request, as the Secretary of the association, I take pleasure in presenting to the members, at the 14th annual convention, a summary of the replies received to the inquiry regarding these lighting units.

For the convenience of this paper, and to comply with the requests of several of the stations reporting, no names are given, but the reports are designated by consecutive numbers.

The inquiry, as sent out, called for the experience of the stations upon the sizes used, breakage in shipment, trouble with discoloration, life, economy, value in meeting competition, advantages of frosted over clear tip, if any, type of shades to be used, manner of disposing of them to the consumer, together with any other information that might be of interest to central station men.

STATION No. 1—located in a city of approximately 125,000 inhabitants, reports as follows:-

We have found the 100 watt tungsten lamp extremely satisfactory. We have used it particularly for competing with gas and gasoline arc lamps, and the only difficulty we have had, has been in the blackening of the lamps after they burn from 50 to 150 hours. This, however, has been corrected at the factory, and we do not anticipate any trouble in the future on this account.

We find the frosted tip lamp has an advantage over the clear tip in some cases, and we use about an equal number of each.

The type of shades used with the tungsten lamp is of great importance. We believe that this lamp is a commercial success, and have hopes that its initial cost will soon be reduced.

We have found that the average breakage from all sources, including handling, premature burn outs, etc., amounts to about eight per cent of the total number of lamps handled; which number amounts to 900 lamps.

We believe that ten per cent of the total number of 100 watt tungsten lamps handled, would be about the proper average to figure on for all kinds of trouble, including break downs, burn outs, broken lamps in shipment, defective lamps, etc.

Up to the present time, we have not thought well of the 40 and 60 watt and have preferred to let other companies experiment with the same. However, we are gradually reaching the point where we believe that the 40 and 60 watt lamp is a success, and during the coming six months will gradually take them on our circuits in limited quantities, and find out what we can do with the same. We do not rent the tungsten lamps, but sell out-right and sell renewals.

STATION No. 2—located in a city of approximately 12,000 inhabitants:

Tungsten lamps are certainly a good thing to compete with gas or gasoline plants. Some of the earlier tungsten lamps have blackened a little, but the same does not seem to interfere with the quality of the light.

As to life, the lamps are something extraordinary. In four months' time none have burned out, although there have been a few breakages from rough handling. We find it to be the best policy to insist on putting up the lamp ourselves, see that it is installed properly, see that it will not be subject to vibration, after we have had no complaint from lamp failing. We have had 50 four amp. series lamps on our magnitite arc circuit now for four months, and have not as yet had a single breakage. I believe the series tungsten will last three times as long as a similar G. E. M. series lamp, and a multiple tungsten ought to last twice as long as a multiple carbon lamp, and up to the present time we have noticed no diminution in candle power with life.

The tungsten lamp has only the disadvantage of its present high price, and the difficulty of adapting it to lighting fixtures now in use. It positively will not give satisfactory results, unless installed in a vertical position on a lamp or drop, or on a fixture suspended with a chain, so as to be flexible; or in some location, where there is no vibration, a stiff fixture can be used, provided the socket points straight downward.

We have used all frosted tip lamps in holophane shades, and believe the 60 and 100 watt sizes are most desirable to introduce. The filament is too delicate in the 40 watt size, although we have a number in satisfactory use.

When the tungsten lamp becomes cheaper in price, it ought to give a great impetus to the electric light business.

STATION No. 3—located in a town of approximately 4,000 inhabitants:

1 1

We have been using 60 and 40 watt lamps since the first of the year, and are now using a few 100 watt lamps, and find that they are very economical, and are bound to be the future lamp.

We have had six broken lamps out of five cases, and three lamps to burn out. We install these lamps with pendant switches, which prevents any jar to the lamp. We have already replaced three business places that were using gasoline for lighting, and are looking forward to the time when we can drive all of the gasoline plants out of business.

We charge our consumers the difference between the price of a tungsten and a carbon filament lamp, and find that they are glad to pay the difference, for they more than pay for themselves in the amount of current consumed, besides making a nice, clear white light.

STATION No. 4—located in a city of approximately 40,000 inhabitants:

We have at present installed on our system about 500 tungsten lamps of the 40, 60 and 100 watt sizes; but we have not had these lamps installed long enough to arrive at a definite conclusion as to the difficulties with blackening and short life.

In the month of May we put out 75-100 watt, 30-40 watt and 34-60 watt lamps. We had to replace 11 of the 100 watt inside of ten days after they were installed, due to burning out in that time, and 4 of the 40 watt, and 3 of the 60 watt. Out of a shipment of 200 lamps, we received 13 broken.

We use frosted tip lamps altogether with the 100 watt size, and with the 40 and 60 watt, according to the circumstances surrounding the place in which they are used.

We have been able to replace a great many gas arcs with the 100 watt lamps, and they give entire satisfaction to our customers, both in the quality of the light and the cost.

I feel that the tungsten lamp has been a great deal of benefit to us in securing business that we have never been able to reach before. I think that the manufacturers will be able to overcome the delicate filament in a short while.

STATION No. 5—located in a city of approximately 150,000 inhabitants:

This company has not as yet taken up the tungsten lamp proposition, except to encourage local dealers to sell the lamps. We handle these lamps for 5 per cent over our cost, having them shipped directly to the local dealer; he to assume all loss on account of breakage, etc.

The only experience we have had with this lamp was with a lot of twenty-five 100 watt lamps sent in by the factory to use for photographs. We are using several on the company's property, and with one or two exceptions, they seem to give the proper light. We have three or four customers using the

tungsten lamps exclusively, and they are apparently satisfied. They purchased them of the supply dealers.

We wish to encourage the use of tungsten lamps, but have not, as yet, determined how we are going to supply it to our consumers; and for the present will not furnish the lamp direct.

Our opinion is that this lamp will eventually put an end to free renewals, and that the light companies will furnish power only; the lamps being purchased from the dealers.

STATION No. 6—located in a city of about 8,000 inhabitants:

This station allows the supply houses to handle tungsten lamps. They handled a few when they were first introduced, but had trouble with short life; the result being that the customers that were furnished were dissatisfied and expected the company to rebate on the same. Consumers seem to be willing to purchase from supply houses without any guarantee, but when purchasing from the company expect results to be satisfactory and life guaranteed.

STATION No. 7—located in a town of about 4,000 inhabitants:

This station reports that they have used the lamps but a short while, and that it was too early, as yet, to report definitely, except as to their economy. They find the lamps to be very economical and that the quality of light seemingly improves with the age of the lamp. No blackening has as yet developed, and they have had no breakage. Neither the consumers, nor the company, can find any defect in the lamps to complain of.

REPORT No. 8—from Wiring Contractor firm:

We find that the tungsten lamp represents a marked advance in the lighting business. That its economical advantages have never before been equalled, and that it makes work easier to procure. It enables the business man in moderate circumstances to display his goods in the right way, at a cost not exceeding his former method of lighting.

We find that breakage in shipments has been reduced to a point, that they equal with the carbon lamp.

STATION No. 9.—located in a city of approximately 8,000 inhabitants:

This station reports that they have used the tungsten lamps to a limited extent, having now installed three standard packages of these lamps.

Aside from the price and life of these lamps, they have found it a very valuable help in getting new business, and in displacing gas and gasoline competition.

All of the lamps are installed with holophane shades, and in vertical position; operated by either wall or pendant switches. A trial of one lamp

turned on and off at the socket showed that such installation would not stand the jar.

The quality of the light is exceptionally good and satisfactory to the consumers. The efficiency of the lamp is fully equal to the claims of the manufacturers, and the breakage in shipment has been very small; out of three standard packages, there were but three broken, one of these being replaced by the manufacturer.

This company reports that they find the clear globe to have an advantage over the frosted tip for store lighting, and that they have not sought to introduce the tungsten lamp for residence lighting.

The principal trouble encountered has been with the life of the lamp, and price. The claims of the manufacturers as to life have not been realized. And while the time has been too short to give full statistics upon this point, their experience has been such as to warrant reducing by half the claim of the manufacturers of the number of hours of normal life.

This company has kept a careful account of all of its installations, and submits the results on five installations which are given below under consecutive numbers.

These installations were placed on a rental basis; the company giving the consumer the privilege of buying the lamps outright at a price of 10 per cent off list, or of paying a monthly rental of 25 cents per month for each 60 or 100 watt lamp, and 20 cent per month for each 40 watt lamp installed; the company taking care of the lamps and furnishing the renewals under this rental. About half of the installations have been by purchase, and about half on the rental basis

As there has been considerable inquiry as to rental, the installations reported cover that kind only.

INSTALLATION No. 1—Saloon, 5—100 watt G. E. Make; displaced artificial gas. Started Feb. 17, 1908.

	Hours Burned.	Cost.	Rental.	Loss.
1 Lamp	245	1.65	.50	1.15
1 "	315	1.65	.75	.80
1 "	615	1.65	1.25	.40
2 "	660	3.30	2.50	still burning

Consumption 219 k. w.

Cost of free renewals if carbon lamps had been used—\$3.28.

INSTALLATION No. 2—Saloon, 3—100 watt lamp, G. E. Make; displaced artificial gas. Started March 2d, 1908.

	Hours Burned.	Cost.	Rental.	Loss.
1 Lamp	140	1.65	.25	1.40
1 "	255	1.65	.50	1.15
1 "	580	1.65	1.25	still burning

Consumption 265 k. w.

Cost of free renewals if carbon lamps had been used—\$3.98

INSTALLATION No. 3—Barber Shop 4—40 watt. Nat. Asso. Displaced 4—32 cp carbon. Started March 1st, 1908.

	Hours Burned.	Cost.	Rental.	Loss.
1 Lamp	515	1.23	.80	.43
1 "	535	1.23	.80	.43
1 "	555	1.23	1.00	.23
1 "	590	1.23	1.00	still burning

Consumption 99 k. w.

Cost of free renewals if carbon lamps had been used—\$1.48.

INSTALLATION No. 4—Millinery Store, 9—100 watt G. E. Make; displaced artificial gas. Started April 19th, 1908.

	Hours Burned.	Cost.	Rental.	Loss.
9 Lamps	306	14.85	\$9.00	still burning

Consumption 184 k. w.

Cost of free renewals if carbon lamps had been used \$2.76.

INSTALLATION No. 5—Bakery, 3—100 watt G. E.; 2—60 watt, Nat.; displaced artificial gas.

	Hours Burned.	Cost.	Rental.	Loss.
3—100 watts	328	4.95	2.25	still burning
2—60 "	328	3.00	1.50	" "

Consumption 52 k. w.

Cost of free renewals if carbon lamps were used—.78.

From the examples given above, the company has come to this conclusion:

That the claims of the manufacturers as to life of the lamps are not sustained. But even on the showing as made, the company being upon a free lamp renewal basis, feels justified in continuing the experiment of renting the

lamps. If the life claim of 800 hours for these lamps had been realized, a very different showing as to the loss on renewals would be made. In estimating the cost of free renewals, one-half cent per k. w. has been taken as the basis.

CONCLUSION

From the foregoing reports we are able at this time to form the following conclusions:

1 That the tungsten lamp has been in use too short a time to judge fully as to its adaptibility for general use.

2 That the price as now charged is exorbitant and will prevent its coming into general use, unless reduced.

3 That the life of the lamp is shorter than that claimed by the manufacturers, or that it does not permit of a wide range of conditions such as must be met by any lamp in general use.

4 That the brilliancy and economy of the lamp is particularly good.

5 That while fragile, it has borne shipping with fairly good results.

6 That discoloring of the lamps has not been bad, nor has such change effected the quality of the light.

7 That it is a valuable adjunct in meeting competition, and where installed in the proper manner, which must be vertical, it gives excellent results from the illuminating standpoint.

8 That the larger units as now made are most desirable.

9 That until the price is reduced, the most satisfactory method of disposing of them to the consumers is through the supply houses.

Respectfully submitted,

D. L. GASKILL,
Editor.

**REPORTS NOS. 10, 11 AND 12 WERE RECEIVED TOO LATE TO PRINT,
BUT ARE AS FOLLOWS:**

No. 10.—Our experience covers a period of about six months to date. (August 8, 1908). This is a small town of 3,000 inhabitants. We have 100 60-watt lamps in use, 150 40-watt lamps, and about 20 100-watt lamps. Outside of breakage to shipping, which is small, we have had very little complaint from customers; about 6 or 8 lamps have gone wrong after a few hours use.

For business houses the 60-watt, and for residence the 40-watt lamp seems preferable. However, I think the 100-watt lamp will become the leader for business rooms.

We have no competition other than gasoline, which the Tungsten successfully meets. We are able to put out gasoline plants as result of the introduction of the Tungsten.

We have the same rate per k. w. as for the carbon lamps, but think the price will be increased. We sell all our lamps to customers. No free renewals. We get new business and all business is very satisfactory, except that our revenues do not materially increase; the loss is low, consumption about balances the increased business thus far.

No. 11.—We have the Tungsten lamps in service since March 1st, of the 100-watt size and the 40 and 60-watt since April 15th (date of present writing July 24th, 1908); have a total of 500 in use at present writing; get an average life of 1,000 hours. Have 60-watt lamps on test that have run over 2,800 hours.

The only trouble we have experienced was with the General Electric 100-watt size; the first shipment we received in March lamps did not have perfect vacuum.

We have replaced gas arcs with Tungsten that we could not with Gem lamps; have also replaced quite a number of 5-Amp. arc lamps; we furnish free renewal carbon lamps, furnish arc lamps and carbon, is why we are pushing the Tungsten to take their place.

We sell the 40-watt at \$1.50, 60-watt, \$1.75, and 100-watt, \$2.10. We estimate we will save in lamps and carbons \$2,000 per year, and get new customers with Tungsten lamps that we could never get with other lamps. We have just received sample 25-watt Tungsten; we charge two cents per k. w. more for all Tungsten service than we do for carbon lamps. We have only lost 11 lamps by breakage up to this time; we are well pleased with the Tungsten proposition and are anxiously waiting for the 25-watt lamp for residence lighting.

No. 12.—Up to this date, July 24th, 1908, we have not decided upon a policy to pursue regarding the placing of Tungsten lamps, leaving that to results from the lamps which we have installed up to July 15th. The question of policy to adopt is one, we think, which demands careful consideration from every angle. We have 30-cent gas to fight, and our policy regarding Tungsten lamps must be flexible enough to fit the majority of old as well as new customers. For that reason we are awaiting results from 60 100-watt, 40 60-watt

and 25 40-watt lamps, which have been installed within the past thirty days previous to July 15th. From a lot of 100 100-watt, 50 60-watt and 50 40-watt lamps we only lost by breakage in shipment one 100-watt and one 60-watt lamp. Through breakage while burning or in use on customers' premises we have lost two 100-watt, two 60-watt and three 40-watt lamps.

We have placed tungsten lamps in several stores where our current income has been decreased about 40 per cent, and in others where it shows an increase of about 25 per cent because of cutting out natural gas and using Tungsten lamps almost exclusively. These instances are where we are selling current at meter rates. Our flat rate customers, as near as we are able to trace them, take advantage of that fact notwithstanding that we charge retail selling price of \$1.90, \$1.60 and \$1.35 for renewals after about 500 hours burning. However, this class of customers has not had time to burn the lamps long enough to demand renewals. When they do, we think they will be careful as regards burning when not needed.

We find the 100-watt and 60-watt lamps best adapted for use in gas competition. The customer pays for first installation as per prices given above. Where customer is using on meter basis we do not change rate unless flat rate is asked for, then we try to average 10 cents per 1,000 watts for five hours burning per day per lamp, regardless of location of lamp, whether in dark part or light part of store, that is, basements, first floors and above are considered equally in arriving at average hours burning.

We think a flat rate proposition for Tungsten lamps would be profitable if we could control the hours' burning, but as each individual uses light differently this scheme does not appear feasible. The Tungsten lamp we think will be a winner for us if we can only fix upon some policy which will not be too hard upon the customer, and we are delighted to learn that this matter will be given careful consideration at the convention; and further assure you we are ready at all times to assist the cause in any way within our power.

President Tait: This is a fine report. I am sure that you have been interested. I believe that a very full discussion ought to take place on this paper.

Discussion.

Geo. Osborn (General Electric Co.): In considering this report, which is a summation of the experience of central stations of Ohio on the Tungsten lamp, we are certainly satisfied that the central stations in Ohio are enthusiastic users of the Tungsten lamp. The first eight stations are very favorable in their conclusions as to the service performed in obtaining new business with the Tungsten lamp. Station number nine, which makes a detailed report of five installations, enumerating carefully the total hours, life of each lamp, cost to central station and rental received thereon presents a good subject for analysis, which I have made in the following manner: Considering the five installations as a whole and not in part, we note that there were

26 lamps installed, and of this number 8 were shown to have burned out, and 18, or 70 per cent of the total mentioned, are still burning. The average life of the early burned out lamps equal 397 hours; and the remaining 18, or 70 per cent, were still burning at the end of 382 hours. The total amount paid for the Tungsten lamps, considering them at a price of \$1.65, would aggregate \$42.90; the total that would have been paid for carbon lamps as given in the report amounted to \$13.28, showing a differential or additional cost for Tungsten lamps \$29.62. Five new installations were obtained involving the displacement of gas or gasoline at a cost to the central station at the present time of \$6.27, eliminating the rental which will accrue from the 70 per cent of the lamp still on circuit. The report indicates that the installations were used on an average of 4 hours per day, and at a rate of 10 cents per k. w. hour the income thus far received has been \$100. Surely this is making one blade of grass grow where none grew before. Even with the apparent short life showing made by this central station it can thus be seen that the use of Tungsten lamps was of great benefit, and there is every reason to believe that the short life of the lamps mentioned in installations Nos. 1 and 2, which were both saloons, was caused by mechanical reasons due perhaps to vibration of lamps when they were not burning, or carelessness in cleaning and maintaining lamps. This would seem to be confirmed by installations Nos. 4 and 5 which showed 9 and 5 lamps respectively, with none burned out at the end of 300 hours.

The report by several central stations outside of the state of Ohio, on the question of the life of lamps installed in their offices, of which careful record was kept, is given in the following:

Minneapolis General Electric Co. total installations, 30 lamps; 6 lamps averaged 240 hours; 6 lamps averaged 860 hours; 16 lamps averaged 1560 hours; 2 lamps averaged 4000 hours; the average per lamp 1318.

In Des Moines, Ia., 10 lamps were installed for test, and at the end of 1460 hours all lamps were burning.

In Elgin, Ill., 6 lamps were installed in their offices, and up to the last report had reached 1256 hours, without a burn out.

A successful method of satisfying a prospective customer on the life of Tungsten lamps is to show him what the minimum life is that the lamp will pay for itself as compared with an installation of the same candle power obtained with carbon filament lamps on free renewal basis. In the above report, where the price of the lamp is given at \$1.65 the 100-watt Tungsten lamp pays for itself in current saved on a 10 cents per k. w. hour rate in 92 hours; and therefore, in the average life shown, above every lamp has paid for itself four times over and 70 per cent were still in service.

The question has been asked by central stations why they should endeavor to install Tungsten lamps among their customers who are exclusive electric light users? That has been answered by one progressive central station manager in this way; first take care of your friendly customer who is an exclusive electric light user, and retain his good will by giving him the best

that can be obtained for the amount of money that he has expended, as it is but little incentive for a man to be a satisfied customer if only the complaining customers are offered better service.

Second, get the lamps installed properly, which can only be done under your direction. This is better than having the suggestion come from outsiders who will invariably advocate one-third the current for the same illumination rather than your policy which will be three times the light for the same money.

Third, advocate the use of the lamps, showing some of your consumers how to make a saving, and then send your solicitor around to close the customer for that motor, sign or outline that you have been working on for the past several years. If he makes this saving through the advice of a contractor the way for your solicitor to obtain more of his business on any of the above new work will hardly be smooth.

Fourth, remove the incentive for a competing electric light plant or municipal ownership proposition by removing the cause, that is, high prices for poor lighting. You will surely find that the possible loss of revenue from a few customers will be more than offset by the additional business hitherto impregnable, but now made possible by the introduction of the Tungsten lamp.

There are three methods in use by central stations at the present time in handling Tungsten lamps, and most companies are offering their consumers the alternative of at least two of these. They are, first, a direct selling price which should be such as to retain the good will and co-operation of contractors who desire to sell the lamp and who will ably supplement your soliciting force; second, the rental policy of charging a given amount per month for installing and maintaining lamp and reflector, and some times the fixtures. For an ordinary small store averaging 1000 hours use per year, a rental of 15 cents per month will return to the central station \$1.80; or a charge of 20 cents per month will bring in \$2.40 per year, on which there should be but one renewal of the lamp. An additional motor rate of one cent per k. w. hour for central stations that are at the present time giving free renewals, or 1½ cents per k. w. hour where carbon lamps are sold, can be used by central stations who are desirous of adding a large number of new customers. In addition the lamp has been successfully used by central stations to encourage window lighting, and in many cases this has been accomplished by making a total charge of \$1.25 per 100-watt Tungsten lamps per month, averaging 5 hours per day burning, in which 25 cents represents the cost of maintaining lamp and \$1.00 the total charge for current, which will average you 7 cents per k. w. hour.

Some lamps of early manufacture blackened badly shortly after being put in service. This defect has been taken care of by the manufacturer and practically eliminated.

Attention is particularly called to the new 250-watt Tungsten lamp, which has a lower per k. w. hour renewal cost than any other type in present use. This lamp gives a horizontal candle power of 200, and with a reflector a distributed downward candle power of 300.

Max Harris (Nernst Lamp Co.): I do not want to pose as an advocate of the Tungsten lamp, nor am I particularly interested in the carbon filament lamp. At the same time the figures given for cost renewal seem to me out of all proportion to what all of our experience has been. While it may not affect the results, yet I would like to call your attention to the fact that the renewals of carbon filament lamps were based on $1\frac{1}{2}$ cents per k. w. hour. I would like to have the contract of maintaining all carbon filament lamps installed at $1\frac{1}{2}$ cents per k. w. hour. It makes quite a difference in the presentation of the comparative cost of operation of the two different systems.

E. F. Gwynn (Delaware): All the reports that have been read it appears to me are misleading in so far as they do not mention the regulation or service under which those lamps have been run; that is, whether they have been run at voltage, or below, or above voltage. In one installation of 100-watt Tungsten lamps, we found recently that we had received \$22.90 revenue from five lamps with a total cost for lamp renewals of \$16.50. They were run at the exact voltage of the lamp barring a little bad regulation. We have just had regulation in our place, but I do not believe it will run over 4 or 5 per cent, perhaps due to a switch or something of that kind. It is pretty fair regulation. We have not found the light of the Tungsten lamp anywhere what they claim for it.

President Tait: I am sure that there are some gentlemen here who can enlighten Mr. Gwynn on the effect of the regulation of Tungsten lamp. He would like to know what is the widest variation that you can use Tungsten lamps. He would like to know what is the widest variation that you can use Tungsten lamps on a circuit and get reasonable results. I would be glad if some one would tell him that.

F. D. Elwell (Sidney): We have used a good many Tungsten lamps on a voltage about 4 per cent higher than the line voltage and have gotten excellent life out of them. Our regulation is pretty good, but once in a while there is an occasional jump, which is due to the fact that we have gas engines and once in a while the igniter will stick, or something of that kind. The other night I was in a lodge room lighted entirely by Tungsten lamps, and when this happened I was surprised that there was so little variation in the light. I noted that particularly because I had seen it occur with the carbon filament lamps before when there had been a good deal of variation. We have told people that they are not so subject to voltage variation as the carbon filament lamp. By getting the lamp voltage about 4 or 5 per cent high we have obtained a light that varied from 600 hours to 1800 hours, averaging considerably over 1000 hours.

We have not had any blackening. We have had very little breakage. We have been able to weed out a couple of gasoline plants. They had an explosion one day, and we were "Johnny on the spot," the next morning with the Tungsten lamps, and that fellow is a booster now for the electric light; there is another in town, and we will get them.

President Tait: What is the experience of the central station men here as to the average effect produced by over voltage on the Tungsten lamp; in other words, will you get better or worse results with the Tungsten lamp with the same voltage over-variation? Suppose we have a circuit running 4 volts high from normal, what will be the straining effect upon the Tungsten lamp as compared with similar effects you get on the carbon filament lamp?

C. C. Custer (Piqua): Our voltage is right on the dot all the time; we have not had a 100-watt lamp burned out since they were put in; they have been in about six months. Some of our Tungsten lamps are of different voltage from others. We have had some of 115 volts, and have been burning some 110 volt Tungsten lamps on 115 volts. They seem to stand the racket; some of them have been in three months and not burned out.

About the matter of forcing the Tungsten lamp, I think it will stand some abuse in forcing the voltage up on them very much better than a carbon filament lamp. There is danger of getting a lamp too high voltage for the circuit because it does not give the same quality of light. Here is a thing that goes to prove that the Tungsten filament is not destroyed by forcing voltage like a carbon filament is, because we have a lot of series Tungstens on a 4 ampere magnetite circuit; of course you all know how it is when you have a tub transformer when starting up you start the other circuit it is very destructive to a carbon filament lamp and if there is a little over-current liable to burn the lamps out at that time. Our Gem lamps on this series circuit, and we have a great many of them, would burn out on account of the extra pressure at the time of starting; but the Tungsten lamps installed six months ago, 4 ampere lamps of 32 candle-power we have them in use now for about six months and they are burning about 9 or 10 hours a night. I have not thought about what the hours of life are so far. Six months at 200 or 300 hours a month would be about 1800 hours. Not a single lamp has failed yet except one lamp that accidentally got across a 1100 volt main. The increased light is especially noticeable when you have the rather large filament lamp. We have some 250-watt Tungstens. There were few of them broken in shipment, it seems like the filament hangs together so much better. The main part of the filament seems so much solid. I hope before very long we will have that larger filament. The Tungsten lamps with us have certainly made good on all claims for life of the lamp; they have come up to promise.

A. C. F. Kelcher (Holophane Co.): I think if a general canvass of Ohio were made the majority of the central stations would agree that the lamp has given satisfaction. I know personally of a great many laboratory tests which have been made on the life of the lamps which have run into enormous figures. At the same time I know of a great many occasions where it has been used in public in stores; and there is one place in particular that I saw the lamp mounted on an angle in Toledo. Three months ago I noticed series lamps burning on an angle straight out in a window. I did not question the man, did not speak to him, simply noticed it at night; I went back three months later and I saw that same installation there, which proved that it was

delivering the goods and that it was all right, or he certainly would not have burned that lamp continuously in that position. The lamp companies today are recommending the lamp in that position. Of all the tests I am sure that the majority of them are favorable, and that the 60-watt lamp at the present time is far more serviceable than the others. Personally I have carried one in a suit case which is very heavy and is handled just like any ordinary suit case, and it is operating o. k. I do not think the lamp is quite as fragile as people are led to and do believe it is; and the shortening of the life of the lamp and the other disadvantages of the lamp I think are directly due to the way in which they are installed by the people, not because of the faulty construction of the lamp.

President Tait: I understand that the ladies are very angry at the delay that is being caused by this meeting. I do not want to sacrifice my reputation entirely; so with your permission, let us have this discussion continued tomorrow; and finish it up in good shape then.

Accordingly an adjournment was now taken until 9:30 a. m. Thursday morning.

FOURTH SESSION—THURSDAY MORNING, AUGUST 27.

The convention met pursuant to adjournment, President Tait in the chair.

Secretary Gaskill submitted for action by the convention the following applications for membership, duly endorsed and favorably reported by the Executive Committee.

On motion the action of the Executive Committee was approved and the several applicants elected to membership, viz:

Active.

The Home Lighting, Power & Heating Co.
 The Chillicothe Electric Railroad, Light and Power Co.
 The Citizens' Light & Power Co., Xenia, O.
 The Fremont Yaryan Company.
 The Tuscarawas County Electric Light & Power Co., New Philadelphia, O.
 The Eaton Electric Light, Power & Ice Manufacturing Co.
 The Lexington Electric Light Plant.
 The Wooster Electric Company.
 The Cleveland Electric Light & Power Co.
 The Ashland Gas & Electric Light Co.
 The Bridgeport Electric Light & Power Co.

Associate.

The Wm. Hall Electric Company, Dayton, O.
 The Simplex Electric Heating Company, Cambridge, Mass.
 The American Electrical Heater Company, Detroit, Mich.
 The Union Electric Company, Pittsburg, Pa.
 The Diamond Rubber Company, Akron, O.
 The Standard Underground Cable Co., Pittsburg, Pa.
 The American Electrical Works, Chicago, Ill.
 The Federal Electric Company, Chicago, Ill.
 The Duncan Electric Manufacturing Co., Lafayette, Ind.
 The National Metal Molding Company, Pittsburg, Pa.
 The Indiana Rubber & Insulated Wire Company, Jonesboro, Ind.
 The Wm. D. McJunkin Advertising Agency, Chicago, Ill.
 The Jandus Electric Company, Cleveland, O.
 The Ambos-Cudmore Company, Cleveland, O.
 The George Worthington Company, Cleveland, O.
 The Holophane Company, New York, N. Y.
 The Cutler-Hammer Manufacturing Co., Milwaukee, Wis.
 The Ideal Electric & Manufacturing Co., Mansfield, O.

Secretary Gaskill: In regard to the banquet that has been arranged for tonight, I would ask all of you to call at the Secretary's office upon the adjournment of this session and get your tickets. The ticket that you receive will have your name upon it, and is non-transferable. You are kindly requested not to get tickets if you can not attend, because the number of tickets that are given out will have to be the gauge of the number of plates that will be laid in the dining room tonight.

I would state that this banquet is the gift of the Association to all attending, whether Associate members, Active members or visitors. It is absolutely free, and we want everybody to remain for it. The banquet will be served at 7:30 this evening. The Secretary will be pleased to issue all the tickets that you need. We would like to have all of you present.

The report of the Nominating Committee was read, as follows:

Report of Nominating Committee.

To the Ohio Electric Light Association:

We your Nominating Committee recommend the following gentlemen to act as officers for the coming year, viz.:

President C. R. McKay, Toledo, O.; Vice President, J. C. Rothery, East Liverpool, O.; Secretary-Treasurer, D. L. Gaskill, Greenville, O.

Executive Committee—F. M. Tait, chairman, Dayton, O.; W. P. Engel, Defiance, O.; M. E. Turner, Cleveland, O.; W. F. Hubbell, Wauseon, O.; L. G. White, Columbus, O.

Advisory Committee—Samuel Scovil, Cleveland, O., chairman; F. M. Tait, Dayton, O.; D. L. Gaskill, Greenville, O.

Publicity Committee—E. L. Booth, chairman, Bellaire, O.; W. A. Wolls, Columbus, O.; W. C. Anderson, Canton, O.

Finance Committee—T. D. Buckwell, chairman, Toledo, O.; L. C. Anderson, Franklin, O.; T. D. Elwell, Sidney, O.

Membership Committee—W. J. Hanley, chairman, Cleveland, O.; C. B. Rodgers, Tiffin, O.; H. H. Cudmore, Cleveland, O.; G. E. Miller, Cleveland, O.; C. M. Lott, Hicksville, O.; C. C. Custer, Piqua, O.

Respectively submitted,

W. J. HANLEY, Chairman,

S. M. RUST,

T. D. BUCKWELL.

President Tait: Gentlemen, what is your pleasure regarding the report of the Nominating Committee?

W. P. Engel, (Defiance): I move that the report be accepted.

Secretary Gaskill: Would it not be well to have the report lay over until the close of this session, so that the members can consider it and offer any suggestions that they may have before a vote is taken on it? I believe that will be a good plan.

Mr. Engel withdrew his motion, and on motion action on the report was postponed until just before the adjournment of this session.

President Tait: Yesterday afternoon when the meeting closed we were right in the midst of the discussion on the Tungsten lamp. We will resume that at this time. Mr. F. W. Willcox, of Harrison, N. J., was about to say something yesterday afternoon when we adjourned. If he will say it now we will be glad to hear him.

Discussion Resumed.

F. W. Willcox (Harrison, N. J.): I think the central station interests have cause for congratulation that the Tungsten lamp is available. There are two features of this lamp that should cause all central station men to rejoice; one is that the efficiency obtained has been secured with a simple form of incandescent lamp. This has not been the case often-times in the evolution of a science or device; the tendency is generally to run to greater complication. It might have been the case that you would have had a device much more complicated, similar to the arc lamps or Nernst lamps, instead of a simple device such as the incandescent lamp. Yet you obtain all this efficiency of 1¼-watt candle-power with no more complication than is involved in the ordinary incandescent lamp. That means a great deal of saving in investment and writing off of old apparatus, because the lamp simply replaces itself in the ordinary course of renewals, and therefore there is no antiquation.

I think the report we heard yesterday is also cause for congratulation as showing that in its inception, the lamp, only having been six months in service, as shown by these reports, has acquitted itself so well. We have never had in the history of any developments I have met with any lamp that has shown

the promise and performance that the Tungsten lamp has. Other developments, such as the Gem, tantalum and improvements in the arc lamps have required much longer time and caused a great deal more complaint and dissatisfaction before finally arriving at satisfactory condition. The Tungsten lamp seems to have arrived almost immediately. The fact that the lamp has arrived is a truth that every central station should take home. It is not a thing of the future; it is not a thing of which you can say that you cannot take it up now; it has arrived, it is giving satisfactory service today, and it can be bought in sufficient quantities to meet any demand. It is giving satisfactory service in the various sizes. The only objection raised is the matter of cost. But the lamp pays for its cost several times over in the course of its life, as you can readily appreciate when I tell you that a 100-watt lamp will pay its additional cost over the equivalent candle-power carbon lamps at any rate above $\frac{1}{2}$ -cent per k. w. hour. It will therefore justify its cost at any rate in force today.

It is now up to the central station to adopt some policy that will insure the lamps being introduced and the consumer given the benefit of it. As far as I can judge it seems to me that experience so far indicates that the most satisfactory policy will be a monthly maintenance charge for the lamp, which avoids the user having to pay full price of the lamp whenever one burns out. The average layman is very obtuse in such matters, frequently, as we know, using a 3.5 or 4 w. p. c. lamp to save lamp renewal cost where a 3.1 w. p. c. lamp would save him several times the cost of the lamp. This condition has been met by free renewal of ordinary lamps. In the same way the logical outcome of the Tungsten lamp would be a monthly maintenance charge.

Reference has been made to the larger sizes. Mr. Osborn spoke of the 250-watt Tungsten lamp. That lamp I can recommend to you. It has proven as far as tried to be very hardy and durable. Where you do not desire to use clusters, where you have a limited number of outlets, one large volume of 250 watts is just the thing. The remark that the larger sizes of lamps were more hardy, and more serviceable applies also to this 250-watt size. The smaller size 25-watt lamp was referred to yesterday by one company as being anxiously awaited. It may be that that lamp will not be such a success perhaps as some anticipated, because the lamp does not save its increased cost to anywhere near the extent that the larger size lamps do. It is probable that the cost of the lamp will not be very much less than that of the 40-watt Tungsten, and the saving of course will be no where near as great. I think in that connection that the 25-watt tantalum lamp should be seriously considered by central stations. That lamp is reasonable in price, listing but 50 cents at present, and while it has not as large candle-power as the ordinary 16 candle-power, yet considering brilliancy it is fully as satisfactory a lamp as the 16 candle-power. For ordinary uses, it is serviceable and more hardy and durable than the Tungsten lamp, and I think in conjunction with the Tungsten lamp it should find wide use in the improved economy which renders these new

lamps necessary. The tantalum lamp has been materially improved in life since its introduction, giving a life on direct current well over 1,000 hours and on alternating current of 60 cycles or less it is found that the light is about two-thirds of what it is on the direct current. It is reported from abroad that the German manufacturers of tantalum lamps are at present doing a larger business than the Tungsten. It is disappointing that this tantalum lamp is not more widely used in this country. It is not as efficient as a Tungsten, but in these smaller sizes this difference in efficiency is not of so much importance. I would recommend that lamp to your especial consideration.

President Tait: I would like to ask Mr. Willcox how he figures that the 250-watt Tungsten lamp with current of say 10 cents per k. w. hour can replace an artificial gas arc lamp with gas at \$1.00 per M., less 15 cents, which makes the gas 85 cents per M. net. I believe that you will find that three 100-watt Tungsten lamps will equal two gas arc lamps under those conditions, using current at 10 cents per k. w. hour net, the gas to be the normal coal gas at the average pressure carried by the artificial gas companies. Now I have not done anything towards competing with natural gas with the Tungsten lamp, because that is a different proposition; but I believe that the 250-watt unit is too large for one outlet to compete with the gas arc as normally found. I would like to know your experience on that line, whether that is not true?

F. W. Willcox (Harrison, N. J.): My reference was not to the basis of cost but to the basis of equivalent lighting value. At a 10-cent rate the 250-watt Tungsten would be more expensive than a four-mantle Welsbach with gas at \$1.00 per M.; but my understanding is that customers will be willing to pay this additional price considering the better quality of the light and superior advantages of electric light.

In regard to the point raised yesterday in reference to the hardness and durability of Tungsten lamps on forced voltage, it is surprising to me that there should be any question on that. The superior ability of the Tungsten lamp to withstand excess voltage can readily be tested by any user by putting a lamp at double voltage in comparison with a carbon lamp. I have seen such a test made wherein the Tungsten lamp was subjected to double voltage twice in succession, with apparently little effect thereon, where two carbon lamps were destroyed in each instance. We have no definite data as to the exact life of a Tungsten under change of voltage; but there is absolutely no reason why any central station should use lamps several volts higher than the circuit in order to insure the life, as the lamps will normally give a sufficient long life without any sacrifice of c. p. and efficiency by using an excess voltage lamp.

President Tait: This is a very live subject, and I hope you will go on and discuss it further.

J. R. Cravath (Electrical World): In regard to your question about the equivalent lighting value of the 100-watt Tungsten lamps and gas arcs, I had occasion to figure out the probable relative value from theoretical considera-

tions, and I arrived at the conclusion that under most conditions two 100-watt lamps would easily replace the ordinary gas arc. It would not do it were the gas arcs always maintained under ideal laboratory conditions, but we all know they never are maintained that way, it is a physical impossibility. Unless they are adjusted just right to give the maximum candle-power from hour to hour you can pretty safely figure that two 100-watt lamps with brow reflectors will deliver as much useful light in the store as one gas arc; and Mr. Tait has stated that he has often been able to do better than that, probably due to the fact that the gas arcs are not maintained right up to par.

President Tait: Yes, that is the fact.

W. C. Anderson (Canton): I think in the introduction of the Tungsten lamp we ought to be very careful to induce people to use as much light as possible. It is a very great mistake to attempt to replace a gas arc with just as small a light as the customer will stand for. I think that with 250 watts per outlet, 200 candle-power, the average light will be considerably better than the average gas arc; but I think our tendency in the introduction of the Tungsten lamp should be to make every effort to get the customer to use more light than he has ever considered that he needed in the past.

President Tait: Mr. Anderson, let me ask you, when the question of price comes up, and that is usually the ruling question in ninety cases out of a hundred in the displacement of the gas arc lamps, how are you going to give the customer more wattage for less price than his gas lamps have cost him, unless there is some peculiar situation whereby you can make him pay 50 per cent more for electric light than he has paid for gas light? The average small store keeper will not do that; so that the proposition is simply one for the central station to displace gas by giving the man equally as good or a little better light for practically the same or a little less cost, or at least not very much more cost than his present gas costs him.

W. C. Anderson (Canton): I would say that in the matter of meeting gas cost that where you have natural gas competition, as part of this state has, it is absolutely an impossibility to meet the cost of gas; but customers are very glad to pay more money, not only 50 per cent more, but two or three times as much to get a satisfactory light. That has been proven very well in our case, not with the Tungsten lamp, because that has only been available a short time, but with other illuminants, the d. c. enclosed lamp, and the Nernst lamp, and the Gem lamp. We have been able to land the business against natural gas, and in fact in the business district of Canton there is very little natural gas used in the stores. In the cheaper and poorer places there is some of it used; but it would not pay us to go after that kind of lighting in the way that would result in getting it; but I do not think that our salesmanship should be devoted to anything other than the introduction of these high efficiency illuminants. We ought to make a feature of improved service, and endeavor to get the customer to light his store as he has never lighted it in the past; if you go into one store and put in Tungsten lamps and give the man two foot candles where he had two foot candles before, probably by making a

greater effort you could have gotten him to put in three; and when you have got him to put in the extra light he will be satisfied and pleased and his neighbor next door or on the other block that sees his store looks a great deal more attractive than his own, is very ready to follow suit.

S. F. Messer (Warren): In putting in trial installations, the idea is to have them such that they will give more illumination than the previous gas or other illuminant installation; and in this way you will have a satisfied customer who will not want to return to the former method.

W. P. Engel (Defiance): I would like to get an expression from the convention as to how many central stations of under 20,000 inhabitants have installed the Tungsten as a feature of their business? Just out of curiosity, to see how many, have them raise their hands. (30 hands were raised as using them.)

W. P. Engel (Defiance): The idea that presented itself to me was, how many aggressive fellows are taking hold of the new Tungsten? How many are standing still?

President Tait: I do not think there are many companies but that would consider themselves aggressive. I would not like to ask that question.

F. W. Willcox (Harrison, N. J.): Ask how many irrespective of size have adopted them.

President Tait: Let us have an expression of that sort. How many are there here irregardless of station that are not using Tungsten lamps. (None raised.) It seems to be pretty general, Mr. Willcox.

O. B. Welsh (Dennison): I think that most of the central stations agree that the Tungsten lamp is a good thing; but there seems to be some doubt in regard to the method of putting out those lamps to the consumer, especially where you have free renewals. The thing that the man will speak about is the cost of the lamps. What I would like to get at is, how many are selling lamps are using the lamps on a maintenance basis, and how many are selling them outright, and if any are using both methods? It occurs to me that a great many of our customers would be willing to take the lamps on a monthly maintenance basis; that is, paying so much a month for maintenance of the lamps rather than to buy them outright; at least, that is my experience. I would like to get an expression from those that are selling the lamp outright to the customers and those that are running on a monthly renewal basis.

President Tait: How many companies are selling the lamp outright of the companies represented here? (25 hands raised.)

W. C. Anderson (Canton): That is not quite so clear as to whether they are making an effort to sell them, or whether they are just selling them as the customers may ask for them. Now we have not made any strenuous effort to sell Tungsten lamps at all. We have sold a few, but we are probably using a few hundred of them; we are not making any strenuous campaign yet for the sale of them. I would like to know as to how many are making an effort to sell them to their customers, or are just using them in what you might term an experimental way?

President Tait: Do we understand that the 25 hands that were up a few minutes ago are making an energetic campaign to sell the lamps outright; is that the idea, or are they doing it carefully and cautiously, to see where they are going to land? My impression is from the report read yesterday that the average station is going at this thing very carefully to find out where they are going to land before they get into it too deeply; do I understand that that is the way the majority are working, or are they energetically pushing it; if they are energetically pushing it, I would like to have them hold up their hands again. Their hands being down, we understand that it is being taken care of cautiously, as I have indicated. (Three hands raised.)

President Tait: Three are energetically pushing it.

Fred. Leslie (Muncie, Ind.): Energetically pushing it, I mean, as against business that we do not have, competition with gas and other illuminants.

President Tait: How many central stations represented here are putting these lamps out on renewal basis, or a rental basis, rather than selling them? (Two hands up.) How many are putting them out on a combination basis, both ways? (Five hands up). The larger majority by far seems to be selling the lamp outright. Now this is a very live subject; I hope that everybody will take an active interest in it. Let us have a lot of discussion on the subject. Mr. Kelcher, have you anything to say?

A. J. Howard (Medina, N. Y.): How many central stations are allowing the customers to have Tungsten lamps at the same rate that they are allowing them to use carbon filament or are they advancing the rate?

President Tait: Do you mean the rate per k. w. hour according to meter? Will central stations hold up their hands? I presume the majority are selling at the same rate as the other current. Are there any central stations here that have attempted to raise the price per k. w. hour on Tungsten lamps?

W. C. Anderson (Canton): It is very hard to give a "yes" or "no" answer to that question. I would say that our system of rates is based on discounts as to the average hours use; and we base the discount on the Tungsten lamp on the candle-power. Now to us that is keeping the rate the same; to the customer maybe he thinks it is a raise.

President Tait: It depends upon the system of rate charging that you have in effect at your plant. If you have a demand, the man's demand rate is less.

A. J. Howard (Medina, N. Y.): In our town the same company owns gas and electricity; therefore, we do not have any gas competition, and we have nearly all the business part of the town using electric light or gas. The greatest proportion use electric light. It has been a question with us whether it would be advisable for us to furnish Tungsten lamps at the same price. Our maximum price is 10 cents per k. w. hour. That has been one of the things that is holding us up on pushing Tungsten lamps. We have all kinds of inquiries, and have put out a few of them to find out how successful they

were. If a man puts in one or two Tungsten lamps we tell him to put in his entire system Tungsten, and charge him 15 cents per k. w. hour, which would make his light cost him considerably less than if he had all carbon filament lamps.

F. W. Willcox (Harrison, N. J.): I do not see how any company can justify an increase in rate beyond the additional cost of the Tungsten renewals. An additional charge of 5 cents per k. w. hour can not be justified, as it is greater than the additional cost of the Tungsten renewals. A central station might increase its k. w. hour rate to cover the cost of Tungsten renewals which is about $1\frac{1}{2}$ cents per k. w. hour, but otherwise I do not see how an increase can be justified.

President Tait: It seems to me that the better way to do would be to give the man more wattage and a greater increase of light rather than an increased rate. It is bad policy to attempt to raise electric lighting rates; it is all right to lower them, but when you start to raise them you get into trouble and I imagine the sentiment in your town would eventually resent it. That would be my opinion.

W. M. Adams (Elyria): I said to a contractor in our town that I did not furnish lamps but would let him have them at factory cost, and I offered to give him current free if he would give an exhibition of the Tungsten lamps, because what I want to do is to satisfy people. There is a man there who takes care of the gas arc lamps on his own responsibility, charging \$1.00 per month per lamp so that they are maintained up to a very high standard candle-power. He uses good Welsbach mantles. He has 100 in use. We have knocked out a great many of them, but it is no object to us to do so, because we are selling gas at 30 cents per M. and we could not make any more money out of electricity at 10 cents per k. w.; but what we want to do is to satisfy the people.

E. A. Bechstein (Sandusky): I do not see how you will make more in adopting Tungsten lamps if you are going to raise your rates when you have a larger unit.

C. C. Custer (Piqua): I want to suggest that it would be a good thing to get out of free lamp renewals through the introduction of the Tungsten lamps. At the price of Tungstens we cannot furnish free renewals without charging an extra rate; but if the Tungsten lamp is maintained at its candle power throughout its life there is a chance to get out of free lamp renewals. If we are not able to raise the rate for lighting with Tungsten lamps it seems to me we can sell the lamps at cost to the consumer and not have to furnish him free renewals which would save us about $\frac{1}{2}$ -cent per k. w. hour. What is your experience about the cost of free renewals?

President Tait: On carbon lamps about $\frac{1}{4}$ -cent per k. w. hour of current consumed.

C. C. Custer (Piqua): That is a small amount, but there is a great deal of trouble with free renewals. People want to carry home a whole basketful and let them lay around for the children to break up.

President Tait: I would like to know if there is any prospect now or in the immediate future of buying the Tungsten lamp more cheaply? How soon can we expect to buy the Tungsten for, say one-half of what we are paying for it today? Most of the central stations are very much worried about the first cost of the lamp. While its economy enables us to show good cause for using it, it will be very much more rapidly introduced if we could buy the lamp more cheaply. That appears to me is the real obstacle. While the lamp is being developed and costs a lot of money to get out, I think all the central station men are concerned about the first cost of the lamp. If there is any one here that can tell us how we are going to buy lamps cheaper, I would like to hear about it.

F. W. Willcox (Harrison, N. J.): I should say that the lamp price will come down in direct proportion to the extent to which the central stations will use it and the increased demand for it. It will be lower in proportion to its production in larger quantities.

President Tait: I do not see how we can ever expect to get a larger number of lamps out then. I understand the lamp factories are unable to supply the full demand.

F. W. Willcox (Harrison, N. J.): The central stations in this country can get all the Tungsten lamps they want. Our factories have a capacity of 35,000 Tungsten lamps a day when you are ready to buy them. We have ample stocks and plenty of facilities for all the lamps you want.

C. C. Custer (Piqua): What do you expect the final cost of the Tungsten lamp to be after the demand is fully developed?

F. W. Willcox (Harrison, N. J.): I could not answer that question fully. It is a matter that only the future will tell. It is not unreasonable to expect that ultimately the price will be probably reduced to one-half of what it is now, if the lamp is adopted and widely used.

President Tait: In your opinion, Mr. Willcox, as a lamp man, is it fair to expect that the Tungsten lamp will ever reach a development such that the price will go down proportionately as the price decreased on the carbon filament lamp? For instance, we bought the latter years ago as high as \$1.25, and they gradually came down to 14 or 15 cents during the course of five or ten days. Is it reasonable to expect that a reduction in the proportion may be anticipated with the Tungsten, or is it going to be a less ratio in drop of price by extended use?

F. W. Willcox (Harrison, N. J.): That is a question that I do not think any one can answer. There are so many factors involved in it that you can not give a definite answer to it; but from the present outlook it does not seem as if it could; yet that does not mean that something may not develop in the way of a cheapening process that one can not foresee now which will make it possible to bring that lamp relatively as low in cost as the carbon; but central stations must remember that we are dealing with a lamp that runs on $1\frac{1}{4}$ w. p. c. instead of 3 to $3\frac{1}{2}$ w. p. c., and therefore even at the same cost it is going to be three times as high. Even at the same cost for

equal candle power the Tungsten lamp renewal cost per k. w. hour will of necessity be three times as high as that of the carbon lamp.

A. C. F. Kelleher (Holophane Co.): Has not the Tungsten lamp wherever installed been a source of satisfaction to the consumer, and have not the installations by a great many central stations made friends with the public and gained their confidence? In other words, one satisfied customer is better than ten dissatisfied customers. I would like an expression from the central stations. I have found in a great many cases where large installations have been made that the owners of buildings, such as large dry goods stores, have claimed that it was worth thousands of dollars a year to them in advertising their business.

J. S. Codman (Boston): The concluding sentence in the report says, "Until the price is reduced, the most satisfactory method of disposing of them to the consumers is through the supply houses." I do not see how that impression was arrived at from this report, which is from nine different parties, one of whom is a contractor. Two do not say how they dispose of the lamps. That brings the total down to six. (The speaker had the printed report in his hand and evidently overlooked the fact that a supplement to the report was read from typewritten manuscript by Secretary Gas-kill). Of these six, four dispose of the lamps themselves, and only two through a dealer. So it appears to me that on the basis of this report the conclusion is that the most satisfactory method is to put out the lamps themselves. Judging from the discussion here this morning I believe that the feeling of the members of this Association is very strongly in favor of putting out the lamps themselves and not through the dealer. I would be glad to hear an expression on that.

President Tait: Have any of the central stations anything to offer in reply to these two inquiries?

F. D. Elwell (Sidney): We have thus far succeeded in putting out enough Tungstens to use up the same wattage that the customer was using before, excepting in one instance where it was reduced purposely to get him on to something else. In the other case the party is well satisfied, and our satisfaction has been equal to his because we have got the same bill out of him.

E. F. Gwynn (Delaware): It is very apparent to me that the fear that has been expressed as to the reduction in consumption of current will not be realized. I have found in introducing Gem lamps that they were great business getters, and I also found that instead of a decrease in the consumption of current by the consumer that there was a slight increase, due to the fact that they went after them pretty strong after the first installation, increased their lighting and added to the volume of their business, while at the same time the customer was pleased with the amount of extra light he was getting. I believe that the Tungsten lamp will work out the same way. Of course, the ordinary business house in a small town watches their lighting bill monthly. If it goes higher you will find them economizing; but if you can

reduce the cost of light you will find them broadening out. It may not be the first month but it will come later on. They will not be as careful. I believe central stations can put out the Tungsten if the renewal basis is fixed on some satisfactory basis. I think that you will sell as much current and also get new business from people that are not now on your line and that you would not have without the Tungsten lamp.

President Tait: I think it is the opinion of the average central station that when a rate is reduced or higher efficiency apparatus is introduced to take the place of other machinery or other appliances, that the central station that is properly operated seldom notices the reduction as producing any change in their gross income, due to the fact of which most of us are pretty well convinced that the majority of people are going to spend a certain proportion of their gross income for light. If you give them twice as much they will use twice as much, and probably a little more because it makes a better showing. I believe that the introduction of higher efficiency units, apparatus or machinery always has that effect provided the plant is properly operated and under good management. Anything further on the Tungsten lamp?

Geo. C. Osborn (Harrison, N. J.): The main question of discussion this morning seems to be the buying price and selling cost, and the light of the lamp. The statement made by the President that a reduction of the selling price ought to make the introduction much easier is hardly borne out by the experience we have had in the central stations that have been selling the lamp. Taking in central stations all the way to the Pacific coast it has been found that those central stations that are selling the lamp at a high price are just as aggressive and getting just as many customers as those that are selling cheaper. The subject of rental basis is one that you can scale down to as low as you care to make it, but the actual selling price of the lamp if it was reduced in any of your cases 10 or 15 per cent, in any of your cases would not effect its sale in your town; and if a reduction in price comes it will be better for a central station to pocket that difference and perhaps be more liberal on the question of early burn-outs or trial installations, or a liberal policy generally in handling the proposition rather than to make a corresponding reduction in price which would hardly count for anything, because if a man wants to get a Tungsten lamp the difference between \$1.65 and \$1.50 is hardly going to be a moving consideration with him. The question of what the life is going to be is often asked, what the minimum life is in which the lamp will pay for itself. A lamp that will cost \$1.80 will pay for itself ten times in 1,000 hours, so that it pays for itself at the end of 100 hours' use.

President Tait: This is very useful information, and I am sure that we all appreciate it.

B. H. Gardner (Dayton): A great many companies seem not to have gone into the rental feature, or charging a fixed sum of rental per month. I went into that pretty carefully when the Tungsten lamp first came out. I

do not remember the exact figures but will give them the best I can. For one 100-watt Tungsten lamp we charge 20 cents a month regardless of the number of hours that he may use it. If a man only burns his lamp about two hours a day we would actually get more, taking a basis of 1,000 hours, than it would cost us to renew; in other words he would pay for his own renewals. If a man uses his lamps $3\frac{1}{2}$ hours a day he pays us just about as much as it cost us to renew them on a basis of 1,000 hours. If he burns them 10 hours a day it will cost us about 2 cents per k. w. hour to renew those lamps, and at the same time we are getting 11 cents per k. w. hour for 10-hour a day service. Twenty-five cents per lamp per month would assure you a little better return. That on 5 hours per day would not cost you anything for renewals.

President Tait: Is there anything further? I believe that Mr. Browne, of Detroit, is here and has something to say on higher efficiency lamp units.

H. M. Browne (Nernst Lamp Co., Detroit): The Nernst Co. is putting out a new line of lamps in both singles and multiple glower types. These new units, called "The New Westinghouse-Nernst" lamps, are characterized by high efficiency, simplicity of design and low cost of maintenance. The new single glower units have screw base renewals. They are made in 66 watts, 110 watts and 132 watts, both A. C. and D. C., 110 volts; 88 watts, 110 watts and 132 watts, both A. C. and D. C., 220 volts. These lamps are equal in illumination to the ordinary carbon filament incandescent as follows: The 66-watt equaling three incandescents; the 88-watt, four; the 110-watt, five and a half; and the 132-watt lamp, seven.

The glower is a radical departure from the glower used in the older type of lamps, both mechanically and in the composition of its constituent parts. The addition to the glower mixture of new materials, whose properties have but recently been established, greatly increase the glower efficiency. The new glowers operate at 6 amperes instead of 4 amperes.

The new ballast is equipped with a bayonet socket, making its replacement an easy matter. It is of extremely rugged design and has very quick action. Voltage variations in the circuit are immediately taken care of, thereby protecting the glower against possible overloads.

The price of the burners, as they are called, consisting of glower and heater mounted on a screw base, is from 50 to 85 cents, subject to discount. There is a scrap value of 10 cents. The low price and the long average life make the maintenance of the new units very low.

The new multiple glower lamp presents many important mechanical improvements. The terminals are concealed in the cap of the housing, thus giving the lamp a more sightly appearance. This arrangement makes it possible to use the lamp in connection with fixture work. The lamp bodies part in the middle, giving easy access to the ballasts. The design also includes an improved globe-holding device.

These lamps are provided with the new wafer heater holder, which allows of the renewal of heaters without disturbing the glowers. The wafer heater,

consisting of a small platinum rod bent in the shape of a wafer mounted on flat porcelain, does away with the use of two or more tubes and greatly simplifies the maintenance.

The efficiency of the new single glower units ranges from 1.2 to 1.4 with regular alabaster globes, of the multiple glowers from 1 to 1.25, depending upon the size of the lamp.

J. S. Codman (Boston): Is it possible to get an expression of opinion as to what is the most satisfactory method of disposing of the Tungsten lamp under present prices, and how they are handling them?

President Tait: Enlighten Mr. Codman, gentlemen, as to how you are handling them and whether you think better results can be gotten through the central station, or through the central station and supply men together, or through the supply men separately? What is the opinion of the Association in the matter? Can we not take a vote and find out how many are in favor of handling the Tungsten through a contractor rather than through the central station? How many are in favor of handling through the central station alone without any contractor? (12 hands up). How many think it should be handled in combination by the central station and contractors working in harmony with each other? (12 hands up.)

A. C. F. Kelleher (Holophane Co.): I would like to ask whether those that prefer to handle it in combination are putting out the lamp at their cost, or at the regular retail price of the lamp?

President Tait: How many would favor that plan?

A. C. F. Kelleher (Holophane Co.): It is reported that in some central stations they put the lamp out at their cost. In doing so they practically close the field to the contractors and the dealers. The question I asked was whether they could do that without causing friction between the two factors?

President Tait: Isn't it a fact that you would have to put the lamp out to show some profit to the contractor so as to get him interested? I do not think the contractor would co-operate unless he could see a little profit in it. In doing that the central station could maintain a price for the lamp that would be satisfactory and show a profit and also be satisfactory to the contractor and give him a profit. I believe that the average central station is doing that very thing in order to get the boosting effect from the contractor. Is that what you mean?

A. C. F. Kelleher (Holophane Co.): A common experience of central stations has been putting it out at cost, while the contractors have been trying to get the retail price for it, in that way causing friction. I think where you maintain the price and give the contractor a chance that that is a very good way to boom it.

Fred Leslie (Muncie, Ind.): We have established a custom on the Tungsten of furnishing them to the contractors at our cost. We have quite a large contract which enables us to buy lower than they can, and we supply them at our cost. Of course they sell at list price and we sell at the same. It relieves them from carrying stock and has proved very satisfactory.

F. D. Elwell (Sidney): We have had this trouble with a contractor that he bought too many Tungsten lamps and got his money tied up. He wanted to get it out and in order to sell the lamps he was not particular about putting on proper glassware, he let the customer talk him into putting the lamps on old fixtures so that they did not give satisfaction. That was one of the reasons for our taking hold of the lamp ourselves, in order to insist upon proper glassware being with the lamp.

E. A. Dechstein (Sandusky): We have had this experience with our contractor. We have three contractors. They would not buy the lamps because they were afraid of them, so that all the lamps that are sold through the contractors are bought from us. We would much rather, so far as we are concerned, have the contractors take hold of it themselves, so that when the lamp was put out there would not be any kick coming back on us.

E. F. Gwynn (Delaware): As the Tungsten goes into use, will we not find that there are good and bad, efficient and defective Tungsten lamps being put on the market? With the old carbon lamps the central stations have to go into handling them and looking after renewals in order to see that the consumer got a good article that would give satisfaction. Is there not danger that inferior lamps would be put out to the detriment of the current consumer and central stations? That is a question that does not seem to have been taken into consideration in all this discussion. It occurs to me that they are not all going to be one quality of lamp when everybody makes them; isn't that the fact?

President Tait: It will be a case of the survival of the fittest.

E. F. Gwynn (Delaware): If they are going all to be of the same quality, efficiency and character of manufacture, why it is all right to turn them over to the supply men; but if defective lamps are going to be put out I think the matter had better be considered pretty carefully before they are turned loose.

A. C. F. Kelleher (Holophane Co.): Is it not true that the average central station controls the situation, that is, that they have the power? The contractors have to take dictation from them, and it is the central station at all times that has the power to handle the lamps themselves if the contractors put out inferior lamps.

E. F. Gwynn (Delaware): That is the reason why the central station has made free renewals, or furnished lamps at very low cost, simply to control the situation. That is the point I make exactly.

Mr. D. L. Gaskill, Secretary Ohio Electric Light Association, of the Greenville Electric Light & Power Co., read his paper on some of the causes of failure in municipal lighting at stations, as follows:

SOME OF THE CAUSES OF FAILURE IN MUNICIPAL LIGHTING STATION

By D. L. GASKILL, of Greenville Electric Light & Power Co., Greenville, O.

The history of municipal ownership of electric lighting stations has been a record of failure when all the elements that enter into the operation of such industries are taken into consideration.

Without a single known or proved exception this record of failure has been continuous and universal. With such a history behind these plants, we must conclude that there are some causes or underlying reasons that are common to all such operated plants and as there are many successful instances of operation and some very notable examples of brilliant success among privately owned plants, we must also conclude that these same causes do not always exist in the case of privately owned stations.

It is reasonable to suppose that with close observation and calculation these causes of failure are ascertainable and if possible the proper remedy should be at once applied. If it is not possible to change this record of continuous failure, then a business that cannot be made a success should be abandoned or turned over to some one that can make it a success.

For the purpose of getting at these causes of failure that are peculiar to municipal plants, I divide these stations into the following component parts:

Investment, construction, management, sub-management, service, rates and business methods. All of these items enter into the operation of privately owned plants but the difference in the methods of dealing with them are very dissimilar:

Investment.

It is a bad business proposition to go in debt for the entire cost of your business. No reputable concern would consider such a step and a company so encumbered in the beginning of its existence would find its credit limited, its business curtailed and financial ruin would be encountered early in its career, but in the case of municipal lighting stations, I can find no record of any of them having had a fund to construct or purchase their plant without going in debt for the entire cost. In the State of Ohio this going into debt must precede any movement toward construction, for under the Burns law no contract can be made by a public body for any purpose without the money for the entire contract being in the treasury to the credit of the fund from which it is to be paid. This means in our state the creation of an interest bearing debt for the whole of the cost before even the land upon which to construct such station can be provided and it is safe to say that in most instances the first installment of interest has to be paid by the municipality before the wheels turn around. This debt if it was fastened upon the plants themselves and if it was required that the plant should pay it or upon failure, to suffer the enforcement of a lien for the debt, would settle the question of municipal ownership of lighting stations without any further legislation or argument. No market would be had for the bonds and in a short time there would be no municipal plants for they would all be sold under foreclosure.

Construction.

After providing a fund for the construction of the municipal lighting station by creating a debt secured by a lien on all the property of the municipality the expenditure of this fund becomes the first consideration of those who are administering the municipal affairs.

The adoption of plans, awarding of contracts, supervision of construction and the creation of the business system for the operation of the station is placed in the hands of inexperienced and sometimes ignorant men. In Ohio this duty is now in the hands of the Board of Public Service or in villages in the hands of the Board of Public Affairs composed of three men elected by the voters and in our cities after January 1, 1910, it will be placed in the hands of one man the political appointee of the mayor.

It is usual in human affairs that before undertaking an expensive or complicated work that long consideration, careful calculation and expert counsel and advice will be taken before embarking in the undertaking. This careful preparation is not carried out in the construction of municipal lighting stations. It may be argued that electrical engineers are always employed to work under the orders of these boards in charge but it is a well known business axiom that the employe is seldom better than the employer and with a board composed of men inexperienced in that which they are doing and ignorant of the complicated subject with which they are dealing, the result must necessarily fall short of the standard required for successful electrical construction.

The cost of the construction of municipal plants is generally twenty percent in excess of like construction for a private company.

There is a radical difference between spending your own money and that of someone else. In the former you aim with an eye single to the best results for the least expenditure. In the latter you give the question what thought and consideration you can spare from your own affairs excusing results with the thought that if the public are not satisfied they can get someone else to worry over the proposition. This leads to expensive and unnecessary construction; lack of attention and knowledge on the part of the governing board, and causes errors and permits lax methods in the work.

Contractors dealing with municipalities are more liable to be dishonest and charge extortionate sums for changes and in the construction of such a complicated affair as an electric lighting station changes to meet any unforeseen condition arising must be made in order to obtain the best results. These changes in municipal construction are exceedingly expensive and for that reason are frequently not made resulting in poor construction and bad operation.

Another fault in the construction of these plants is the failure to get the best and most economical type of apparatus for the uses required. The high cost of construction and the desire to make a favorable showing, frequently prevents the use of the best and most suitable machinery with the result that the station as built will start with the high cost of operation and maintenance.

Management.

Management of municipal lighting stations in Ohio is vested in the hands

on a political board elected for two years and as before stated after January 1, 1910, the management of cities will be in the hands of the Director of Control appointed by the mayor and who will hold his office for two years at the pleasure of the mayor of the city. In addition to the duties of managing public lighting stations, a duty which if properly performed, would require a considerable portion of their time, they are required to supervise and carry out all the executive functions of the municipalities excepting the control of the police and fire departments. Statistics show that the term of service of the members of these bodies have averaged less than three years and under the new appointive law for the cities it will be still less.

Under this short term policy as soon as a member has had experience enough to be of some value in managing a new business, he must give way to someone else without experience and who must gain his electrical education at the expense of the municipality.

Neither is the quality of the men elected for these positions without criticism. By reason of the complicated problems arising in the management of an electric lighting plant the business ability required is of a high order and the political bodies elected at a general election usually do not attain this standard. Under our system of low salaries, public criticism, methods of election and incompetent employes, the competent business man refuses to accept these public positions. There is no trouble in securing plenty of second or third rate men to accept these positions and experience has shown that this class vigorously contest for the privilege of filling these offices with the result that the municipal plant suffers for the lack of business ability in its management. If the defects of this management would stop here it would be bad enough, but politics enters the field and must be reckoned with in the operation of these stations. It will be argued that civil service is a bar to this baneful influence. As a citizen that lives in a town that has had a municipal natural gas system and now has a municipal water system, I wish it did, but it don't. Every change of administration results in some new employes being added and old ones dropped from political consideration only.

Study the municipalities of our state and you must come to the conclusion that the municipal owned utilities are but a part of the political machinery of the municipality in which they are located and very frequently the demand for their creation comes from no other source and the object of their creation is to make them a part of the political machinery.

Sub-management.

Under this head comes the superintendent and in the larger cities the heads of the departments.

In justice to the men that fill these positions, it may be said that they are generally more competent than the body that appoints them, but with low wages, interference with their duties, refusal to carry out their recommendations and working constantly upon the firing line of public complaint they are generally discouraged and hopeless of obtaining satisfactory results. Wages are lower than in privately owned plants. Let a superintendent of a municipi-

pal station in a town of 4,000 inhabitants receive a salary of \$75.00 per month and a dozen less competent men will be after his position. Every time there is a change of administration in the controlling board he must run the gauntlet of these hungry aspirants in order to retain his job, and if he has devoted all of his time and work to the proper operation of the station, there is a strong probability that he will be found short in political activity and must go elsewhere.

He can count on constant interference with his work, not only from the board in control but the public as well.

The city being the owner of the plant, he is constantly importuned to grant concessions, break rules and do other things which his judgment is against. His recommendations are not carried out and he is expected to obtain results under adverse conditions.

The board being usually cramped for funds acts only in case of dire necessity and when poor service results, he is criticised for it when the fault lies in the management. If he proves to be a competent man, he is soon taken up by private plants that pay better wages and assure him steady employment. If he has no ambition to better his condition he stays and the public reaps the benefit of his lack of incentive. His under employees are not of his own selection and their appointment usually tainted with politics, the least amount of work for the greatest pay is the slogan of their cry and the results obtained in the management fall short of good operation and the superintendent is blamed accordingly.

Service.

Upon the theory that the king can do no wrong, the service generally given by municipal plants indicates that the management consider the lighting station as thrice royal. The people themselves being the owners, shut downs, poor lights, outages and like troubles must be taken as a matter of course. Complaints may be made but the superintendent shifts the responsibility to the board, the board excuses themselves for lack of funds and the people afraid of higher taxes continue to suffer without hope of redress.

The outrages of municipal street lighting will aggregate double that of private companies and the service given to consumers is erratic and unreliable. The plant not being compelled to depend upon its income for support fails to show that business activity and attention to service that is required from a successful operated station.

Rates.

The main leak which water-logs the ship of municipal ownership of lighting stations is the rates charged by them for their product. With expensive construction, bad management and operation as against low and inadequate rates, there can be but one result, that of financial ruin.

A study of the municipal lighting rates in Ohio indicates a disregard for the business principles governing the operation of such plants. Of the 98 plants in Ohio the association has the reported rates of 64. Of this number 41 sell current at flat rates and ten of this number report a flat rate of 25 cents

per month per 16 candle-power lamp. It is safe to assume that these lamps burning upon a flat rate will be burned an average of five hours per day or a quantity consumption of 8.4 k. w. for one month, which at 25 cents per month would realize a gross income of 2—41-42 cents per k. w. a rate which in most small stations is 3—1-42 cents less than the actual cost of production.

Not all of the municipal stations are as bad as this, but when the income from these plants is insufficient to pay the interest on the bonds issued for their construction, to say nothing about the bonds themselves and take care of future betterments, it is time to have some legislation to protect the tax payer.

The meter rates as charged by municipal plants are not as a rule less than the rates of private companies, but are inequitable between their consumers. All who grant flat rates, and the most of them are in this list, lose the profitable business to the flat rate system.

Reports as to street lighting by these municipal plants do not bear out the claims of low cost for this service. Of the 64 plants reporting, 38 receive appropriations from the tax funds to assist in providing this service and in many of the instances reported, the amount paid by the municipalities to the lighting plant is sufficient to procure better service from a private company.

It is a well recognized rule in the electric lighting business that rates must differ with different classes of consumers. The consumer that uses 100-16 cp. lamps until 11:00 p. m. is a more profitable customer at a 4-cent rate than the consumer that uses the same number and closes at 6:00 p. m. at a 10-cent rate. Yet in 38 of the 64 companies reporting no difference in rates is granted to consumers, neither is it legal for a municipal plant to grant different rates to different classes of customers. This results in having an unprofitable rate with a majority of the consumers or the loss of the profitable consumers because they cannot afford to burn at the prices charged.

This might be remedied to some extent by encouraging the use of high efficiency lighting units, but the statistics show that the municipal plants do not as a rule take advantage of this type of lamps, for out of the 64 plants reporting, 48 report that they do not use high efficiency lamps and in 10 of the replies they frankly state that they do not know what they are.

The plea that a municipal plant should operate without making a profit is an erroneous one for the plant that is operated upon the exact line between profit and loss will soon find itself on the side of loss only, for the vicissitudes of the business are so frequent and the depreciation so rapid that the company that does not lay by when prosperous will suffer soon in adversity.

This raises the question of betterments to take care of the growth and depreciation of these plants. A surplus in an enterprise conducted by municipality is a rare thing to find. The pleasure of spending other peoples money is so inherent in a municipal body that a surplus in any fund is not permitted. If such should occur the city council would promptly spend it in some other direction. Depreciation is no less in municipal owned plants than in private companies. While there has been no statistics gathered upon this point, it is

safe to conclude that with poor management, construction and delay in providing repairs, it is much more rapid. The depreciation in private plants, after a careful calculation will amount to 14 per cent on the electrical machines, 8 per cent upon engines and pole lines and 4 per cent upon real estate including buildings. It is generally rated at 10 per cent on the average covering all features of the property. Even though actual wear and tear would not produce this depreciation, the improvements in apparatus and methods of lighting are so rapid that good service and construction compel the discarding of the old and the installation of new. Failure to take care of these improvements results in poor service and out of date plants.

Business Methods.

The past six years in the lighting industry have witnessed a wonderful change in the business methods of conducting these properties owned by private companies.

The management that is now content to take only the business that comes to it without hustling for new would be considered out of date and unworthy of the confidence of the public. This kind of management in municipal plants is impossible to find. In the first place there is no need to hustle, for the management does not own it. There is no need to make a profit because the management does not get the benefit of it. Hustling means work. Work in the public capacity is not proper according to the American idea of politically managed bodies, besides pushing means increased business. Increased business means additional equipment, additional equipment costs money and municipal plants are shy on this article. The business activity in the municipal owned stations can be likened to a pup chasing his tail, the management many think they are working but the public hold a different opinion and the results show that they are not.

The question of municipal ownership of public utilities is one which calls for very careful consideration upon the part of our people. There is no use in discrediting a municipal plant simply because the public owns it, but until American people can give more attention to small details, eliminate politics entirely in municipal affairs and educate a line of public servants that are willing to sacrifice their hope of gain to the public good, municipal ownership will continue to be a failure. We will have to become more altruistic in our nature and the whole people will have to be willing to sacrifice their interest to the public weal before we can operate these plants successfully.

In every instance where a competent disinterested commission has been appointed to examine into conditions and report on the question of expediency of municipal ownership of lighting properties, the report has been adverse. I deem that I can close this paper with no more pointed example of this than to give the conclusions of the committee appointed by the city of St. Louis to investigate the advisability of such an establishment for that city.

They found "that the cost of operating a municipal plant if operated in a business like manner for that city would be approximately 2½ cents per k. w. hour or \$69.00 per arc lamp per year.

"They further found and reported that the danger of partisan politics in the management and operation of the plants tended to reduce its efficiency and increase its costs indicating the inadvisability of municipal ownership except as a last resort.

"That municipal ownership in the place of public franchise grants, merely transfers the danger of political mis-management from the legislative body which grants the franchise to the administration afterwards appointed by the legislative body to operate the plants.

"The economy of municipal operation and control has not yet been proven in this country. Only two of the first ten cities, Chicago and Detroit, have attempted it. The experience of these two cities are not such as to warrant the statement that municipal plants would be more economical than contract lighting. In the opinion of the committee the conditions at the present time are unfavorable for the construction and operation of the municipal electric lighting plant for the lighting of the streets of the city and it believes this function should not be undertaken by the municipality if reasonable rates and efficient service can be secured from private companies."

It is to be hoped that for the sake of the municipal lighting stations of Ohio that the legislature will at an early date appoint a public utility commission that will require the operation of such plants to be upon a business basis and that will compel them to dispose of their product at prices that will pay the cost of operation and take care of depreciation, as well as pay the interest on the funds used in their creation.

Discussion.

President Tait: Gentlemen, this is a very excellent paper. If you have any discussion to offer on it, now is the time to do it. It is so complete that it will be difficult to add anything.

Clarence W. Lee (C. W. Lee Co., N. Y.): This most excellent paper of Mr. Gaskill's should be circulated in all the towns and cities of Ohio where there is agitation along the municipal ownership line. It should be put on what we term publicity lines. It could be used in the way that I indicated yesterday by every newspaper in the State of Ohio to the advantage of the lighting companies; not possibly as a whole, but there is a certain psychology in presenting matters to the public in sections covering a period of a few days. Even if it would cost the local companies money for advertising space it would be to their advantage to present a paper of this kind to the reading public of their respective localities. The way to reach them is through the medium of the newspapers. To show how effective a campaign of that character can be I will state that within the last forty days we have succeeded in changing the sentiment of a community of 70,000 where the municipal ownership bug is probably stronger than in any other section of the United States from the municipal ownership idea over to the company idea, and this change of sentiment was brought about even in the municipal government. The aldermanic body has been changed from an adverse attitude to the local company to one in favor of it, and a five year contract has been passed by the city covering

lighting and power in favor of the local lighting company as against a big hydro-electric concern that was purchasing their power at Niagara Falls from the Ontario Power Co., and this is the first break in what is termed the Power Union in Canada. This has been done through publicity methods; in other words, a series of daily talks to the people of the city asking them to support their own local company as against municipal control or a Dominion controlled company. The same methods can be pursued in Ohio in your various cities and towns by using Mr. Gaskill's paper, which I use as an illustration, and presenting that to your reading public. The idea is, a series of talks from day to day, what we term publicity methods as distinguished from advertising proper, although using straight advertising space, in both the opposing newspapers as well as those favorable to the company. It is such methods as that that are beneficial. You can help yourself with your local newspaper

by seeing that they get good anti-municipal talks.

Mr. L. Clifford Anderson, of the Franklin Electric Light Co., read his paper on "Grounding Alternating Current Secondaries."

Grounding Alternating Current Secondaries.

BY L. CLIFFORD ANDERSON, of Franklin Electric Light Co., Franklin, O.

Whenever an alternating current primary conductor comes into electrical contact with a secondary conductor of an ungrounded secondary system, the potential of the secondary conductor is raised to that of the primary conductor with which it is in contact. The contact of the two conductors may be due to a breaking down of the insulation between the primary and secondary coils of a transformer, or it may result from a cross of the primary and secondary wires either within or without the transformer.

The difference of potential between the earth and the primaries of an alternating current system depends on the locations and resistances of the various intentional or unintentional primary grounds, and it may have any value between zero and the full primary voltage; hence the potential with reference to the earth, of the crossed secondary will have a value somewhere between zero and the voltage of the primary circuit. The potentials of the other secondary conductors will be greater or less than this potential by the secondary voltage of the transformer.

Except in that very rare case where all of the primary grounds are confined to that leg of the primary circuit which is crossed with the secondary conductor, the secondary will be raised to a potential above the earth which will be dangerous to both property and human life. Usually the first warning of the high potential on the secondaries is either a fire or a severe shock to someone who touches some part of the electrical equipment in a building while his body is in electrical contact with the ground. Many well authenticated cases of death from this cause might be cited, were it thought necessary for the purpose of this paper.

The preventive of this possible high potential of the secondaries is to permanently ground through a low resistance connection, some part of the secondary wiring of each transformer or bank of transformers. With the secondaries so grounded none of the secondary conductors can have a greater difference of potential to the earth than the amount of the secondary voltage of the transformer. Transformers having their two secondary coils in series should be grounded at the point where the coils are connected together, while those having their secondary coils in parallel may be grounded at either end of the coils.

While satisfactory grounds are not always easy to secure, one of the following methods usually will be found available for this purpose:

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1. Connections to cast iron gas or water mains. These should be made by drilling and tapping the pipe and inserting a brass plug to which the ground wire may be soldered.

2. Connections to wrought iron gas or water service pipes. These should always be made on the street side of the meter. The connection may be made either by carefully cleaning the surface of the pipe and soldering the ground wire thereto, or by means of one of the several clamps designed for this purpose and now upon the market.

3. Copper or galvanized iron plates buried in damp soil.

4. Galvanized iron or steel pipe driven into the ground at the base of a pole, and to which the ground wire may be soldered or attached by means of the clamps heretofore mentioned.

The latter method is the one usually adopted because it is cheapest, and has proven quite satisfactory where the soil is damp.

In localities where the sub-soil is extremely dry and where connections cannot be made to the under-ground piping systems, it is sometimes necessary to make one ground secured in some damp spot answer for a number of transformers by running a wire from this one ground to a common point on the several transformer secondaries.

An easy means of testing the quality of grounds made by any of these methods is to temporarily ground the other side of the secondary circuit in two wire systems, or one of the outers in three wire systems, and blow either a small fuse temporarily placed in series with the permanent ground, or the primary fuses of the transformer.

Recently a question has been raised as to the limiting voltage of the secondary circuits to be grounded. The committee of The National Electric Light Association at the last convention of the Association made a report which was accepted, in favor of grounding all alternating current secondary circuits of 150 volts or less, and prohibiting the grounding of secondary circuits when the potential to ground would exceed 150 volts, and requested that a rule to that effect be incorporated in the National Electrical Code by the board of underwriters. There are many who believe however that the limit of 150 volts is quite too low. A more rational limit would seem to be 250 volts. While it is true the large majority of secondary circuits would be included within the 150 volt limit, many would not. A limit of 250 volts from the ground to any part of the secondary circuit would cover practically all cases where this method of protection is applicable. Since a shock from 250 volts is not dangerous to human life it is difficult to see the objection to making this the limiting voltage.

In conclusion permit me to say the purpose of this paper is not to present something new upon this subject, but rather to call your attention to the dangers involved in operating alternating current systems with ungrounded secondaries, and to the methods commonly used in grounding secondaries.

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Discussion.

J. R. Cravath (Electrical World): There is one sentence in the paper which I would like to offer comment on, in which it is stated that "since a shock from 250 volts is not dangerous to human life it is difficult to see the objection to make this the limiting voltage," the committee of the National Electric Light Association having made a report which was accepted in favor of grounding all alternating current secondary circuits of 150 volts or less. The reason for fixing that limit of 150 volts was because 250 volts a. c., or even 200 volts a. c. has been known to produce fatal shocks. For that reason the chairman of the committee told me personally that the committee did not feel at liberty to recommend this grounding and producing a definitely dangerous condition when it might possibly not be dangerous ungrounded; in other words, if a circuit is dangerous there is no use in grounding it, and the grounding may add to the danger in that case rather than decrease it.

L. C. Anderson (Franklin): It is a question as to what the limiting voltage is. I have never been able to find any cases of death from a shock received from 250 volts or less. I may not have heard of the cases if there are any. I think about the same remark was made at the national convention, but they failed to show where there had been any cases of death from a current of 250 volts. If there are any I would be glad to be advised.

President Tait: Do you know of any cases of death of that sort, Mr. Cravath?

J. R. Cravath (Electrical World): I know there have been cases, but I cannot give details.

President Tait: I would suggest if you find out that you let Mr. Anderson know.

L. C. Anderson (Canton): I would be glad to know of any cases. That question has been up in a great many court cases.

President Tait: We have with us a gentleman who is an expert on the matter of lightning protection as applied to central station line work. I have asked the gentleman to favor us with a short talk on how to properly protect central station lines from lightning. If Mr. Creighton will give us that little talk now, we will appreciate it.

L. C. Anderson (Franklin): Before he begins I would like to say that since writing the paper I have talked with Mr. Creighton and find that he has made some experiments with salting pipe grounds, and if not asking too much I would be glad to have him include a word on that subject.

President Tait: I think Mr. Creighton will probably do that. Will you not?

REMARKS BY MR. E. F. CREIGHTON G. E. CO.,

Schenectady, N. Y.

Mr. President and Gentlemen:

The problem of the protection of electrical circuits is entirely different from the problem as affecting the ordinarily designed apparatus. When you start in at the factory to design a motor or generator, or electric lamp, or anything of that kind, you know what you are designing; you know that you have a certain potential you want to produce; you want to burn so many lamps on a circuit or produce so many horse power in motors. When it comes to lightning arresters, however, the problem was entirely different until very recently. Lightning arresters were built to protect against an unknown condition on the circuit. It is well known that there were induced strokes on the circuit from the discharges of clouds, but what the nature of those induced strokes was was entirely unknown.

During the past three years, in fact, during the past five years, very extensive measurements starting first in the laboratory and then finally carrying the methods to the line, have been made on the conditions of lightning existing on power circuits. I am not going to go into the details of these because that is of less interest, I believe, to this association, and the time is too short. I will simply state that lightning frequently has been measured. During last summer two of us spent the entire time at the Animas Power & Water Co. in Colorado, where they have vicious storms practically every day during the season. The frequency of cloud lightning was measured, and was found to be in the neighborhood of about 1,000,000 cycles per second. The frequency of the discharge from an idle line was also taken and found to be about 3,000 cycles. Then there is a third effect when you have power on and you have an accident to an insulator, in which the frequency of recurrence is the same as the frequency of your generators, say 60 cycles per second.

Next the matter of current was not measured but was indirectly calculated from other tests, and it was possible to pre-determine just how many amperes of lightning current would flow for every volt on the line. Another interesting point, was what was the voltage induced on the line? We have made no tests on direct strokes of lightning, because it is so very difficult to get them; they occur infrequently, and when they do occur it is best to be out of the way. So the only test we made were on the induced strokes, and we found potentials momentarily on the line as high as several hundreds of thousands of volts—between 300,000 and 500,000 volts.

The next thing we measured was the quantity of electricity that was in the stroke. That, of course, varies with every cloud and with the relative position of the cloud and the line. The last thing we measured was the duration, and that is a most important thing, to know the duration of the lightning on the line. The ordinary lightning stroke will have a duration of about 1-100

of a second; but the trouble is not in the actual duration of that stroke, but in its recurrence. We found numerous cases where a stroke of lightning would come from the clouds and within a second there would be seven successive strokes which would extend over a complete circuit. There is one place where your arresters have been, that is the cause of some of the failures of the multi-gap arresters.

There are a great many causes of the high potential surges on the line; most of these can be stewed down to four conditions which I would like to cover. The first is the direct stroke of lightning, and how to protect against it. In your cities, as I conclude, most of you are interested in plants of that nature,—a direct stroke of lightning very seldom ever hits a line; it hits a tree or a building somewhere near, and you have simply an induced stroke. Therefore there is no protection for direct strokes of lightning for this reason, that the lightning goes to ground within a very short distance, say within seven poles from where it strikes, and there is not one chance in a thousand that you could have your lightning arrester situated at that point.

Then the next question is, whether the lightning arrester would take care of the discharge if it were at that point. It would not be economy to design a lightning arrester to do that, because you could not afford to pay for it. It would be so expensive that it would cost as much or more than the apparatus that you were protecting. The only protection that can be given against a direct stroke is to install an overhead ground wire and ground it frequently. Now that is quite unnecessary in the cities because you have the same kind of protection in the telephone wires if they run above your power lines, and in the trees and in the buildings that often overhang the lines.

The second kind of a lightning stroke is the induced lightning stroke which comes from the cloud being over the line, and inducing a static charge on the line, and discharging at some point near the line. That is a problem that is quite easy to take care of and which is pretty well taken care of at the present time by the multi-gap arrester. The multi-gap arrester in its latest improvement has two or three paths to ground so that it can take care of lightning of a different quantity of electricity—different intensity. The only thing that this multi-gap arrester comes up against that it cannot take care of would be one of those multiple strokes that I spoke of. Occasionally though you will find that your multi-gap arrester blows up and goes to pieces when lightning is induced on the line, and in most of the cases we have found this to be due not to the inefficiency of the arrester but to the local condition of the circuit.

The third condition on the line, and it is the most important and the hardest one to take care of, will be due to an accidentally grounded phase, for example, the breaking of an insulator so that the arc can play from the line to the pin, say, or from the line to a green branch, or from the line over to the bushing of the transformer which is grounded. These are the three conditions usually met, which are hardest to take care of. Every time that

the arc jumps from the line to the insulator—and it does it every half cycle as a rule—there is a surge set up on the other phases of the system which will tend to make that discharge through the internal windings or bushing or insulator elsewhere. In so doing it will cause a short circuit, of course, an interrupted circuit. It is far better that it should be interrupted than it would be to let it play, because of the damage that may occur internally in the transformer. In this case you can see that if you have a multi-gap arrester on the circuit, and that multi-gap arrester is designed to take care of the discharge, then it will discharge during the first break of that current, which is the first half cycle of the discharge. It puts out the arc at the end of the half cycle, but again the potential goes in the opposite direction and starts the arc again, the surge is re-established on the circuit again and your multi-gap arrester discharges. Now the multi-gap arrester cannot be designed to carry the current continuously at any commercial cost figure; consequently, under those conditions the multi-gap arrester must necessarily be destroyed. The only lightning arrester that can take care of that condition is the newly developed aluminum arrester, that I will speak of later.

Now the fourth condition that you are liable to meet is something that has come up quite recently and that seems to occur on motor circuits, for example, in a large building where you are feeding a direct current, and operating electric motors for elevators and other purposes, if the load on the building becomes so great that a fuse blows then you have that circuit disconnected from the main circuit and you have the meter on the inside, and sometimes the motor fields discharge through the meter and raises the potential and in that way destroys the meter. You can see that if you have a heavy current flowing through a motor and you suddenly break the circuit you have just exactly the same thing as an induction coil, and the amount of voltage you will get out of that depends entirely on how short you break the current. If the fuse breaks the circuit very quickly then you can get a very high rising potential. The protection for that is a d. c. type aluminum arrester.

These then are the four kinds of lightning potentials or surges that you would usually have to meet: First, a direct stroke of lightning; second, an induced stroke from a cloud; third, an accidentally grounded phase; and the fourth is the inductive kick from a motor circuit through such an apparatus as a meter.

Just one word about the aluminum arrester and the principle that it works upon. The aluminum arrester, no matter what kind it is—there are two forms now that are out, one for a. c. and the other for d. c. The a. c. consists of a series of sells made up from inverted cones, one setting inside of the other and separated by little fiber washers. Between these cones is poured in a certain amount of electrolite, making it about half full; then the whole mass is immersed in a tank of oil, the oil having two qualities; first, that of insulating the parts that are not in the electrolite; and second, cooling off the surface so that the arrester may operate for a long time. Now the

characteristics of the aluminum cell are the same as the characteristics of the arrester; the arrester being made up of multiple cells. If you had a 300-volt circuit you would have one cell; if you had any higher voltage than that you would have the total voltage between, or the ground divided by 300 would give you the number of cells that you would place between the line ground or line to neutral, according to the conditions. The characteristic of each cell is very similar to a storage battery on a d. c. system. If you take a storage battery and let it flow, say on a 600-volt system the cell will take the current until the voltage rises to about 2.2 or 2.5 volts per cell. At that time the current in the battery is reduced to almost nil; but if you should raise the voltage on the circuit above 600 volts, then you would not have a counter electro-motive force of that value, and the current that would flow would be the excess voltage divided by the internal resistance of the battery. In that way if you have a large battery you might have 5 amperes for every volt of increase over 600 volts. In that way a storage battery on a d. c. circuit is one of the best kind of lightning arresters because it holds back the dynamic current and allows only the excess voltage to discharge through it. An aluminum arrester acts very similarly. The aluminum plate surface goes through a chemical process by which a film is formed on the surface of very great thinness. The actual thickness of the film is represented by figures something like .000002. There are about five "G's" before you come to the figure. That represents the thickness of an inch. It is shown on the surface as an iridescent color, slight whitish appearance. The film bears much the same relation to the circuit as the counter-electro motive force does in the battery. We take a single cell on a 300-volt d. c. circuit, for example, then the leakage going through that is reduced to a very small volume; in that case you connect the cell directly to the circuit and leave it on the circuit. The leakage of current will be about .001 of an ampere, but for every volt of pressure above 300 volts that cell will allow current to flow through it equal to the excess voltage divided by the resistance. Since the resistance is very low, about one-quarter ohms, you can see that means about an ampere for every volt; so that by the time you get to double voltage you have about 100 amperes flowing through that cell. I am thinking of a 600-volt circuit. It comes to about the same thing as a 300-volt, so you have a safety-valve on the system. It acts just like a safety valve on a boiler. At normal pressure there is practically no discharge, but for abnormal pressures the valve opens up, there are myriads of them on the surface of this aluminum plate—allowing the electricity to flow through, the same as steam would escape through a steam boiler safety valve. In a d. c. cell the ratio of the current between normal potential and double potential is about one million; in other words, the current increases from .001 ampere to 1,000 amperes. So far as we can see in the study of lightning, that is sufficient to take care of any kind of a discharge that may come on a circuit.

In the a. c. lightning arresters made for voltages from 2,300 volts to 110,000 volts a gap is placed in series in order to prevent the wearing of the

plates by the constant action of the alternating current. The alternating current wears the plates very much more rapidly than the direct current.

Now as to the use of these a. c. lightning arresters, it is not to carry a discharge continuously for half an hour. It is estimated that within half an hour if you get an accidental ground due to a broken insulator or other cause then during that half hour you can throw the switch out of circuit. That is one way of doing if you have an auxiliary circuit. You can send a man out and get pretty well out towards the trouble so that your time of shut-down will be very brief; or a third way to do it would be to put a permanent ground on the wire, that is an accidental ground upon it. If you take any system and connect the wire directly to the earth you will get no oscillations; so you can tell by looking at your lightning arresters, you have a gap between the other line and this stack of cones that I spoke of, and the gap that does not arc is the wire upon which the trouble takes place; consequently, if you put a permanent ground there you can take your time about locating where the trouble is on the line. It is estimated that half an hour should be sufficient, and that will do no damage to the cones; that is they will be put back in service again by allowing the electrolyte and oil to cool down.

In conclusion, I want to state what has been accomplished by these lightning arresters. The cone lightning arrester has been in operation for a number of years. The General Electric Co. is very conservative about putting a thing out of that kind if objectionable from any standpoint, and it is only due to the strongest pressure that they have been willing to accept an arrester of that kind. The arrester last year—or this year rather—has been installed on the Animas Power & Water Co's. line in Colorado where they have eleven of them. During the month of July last year they had about ten storms, and twenty-two shut-downs and interruptions of service. I can not give you exact figures, but only approximately. This year, with the arresters on the circuit at nearly every station, they had 18 storms and no interruptions of service. They had one interruption of service during the month, which occurred at a station where they had no protection. They have 30 stations to protect there, and they did not have time to get all the arresters in. It is in the mountains. This one interruption at that time cannot be attributed to the lightning arresters at all. That in itself is what can be presented as proof of the operative condition of the arrester.

In conclusion I will say that the state of lightning arresters so far designed is such that we can pre-determine before hand just exactly what the lightning arrester will do. That was impossible with the old type of multi-gap arrester, but the new types of arresters are tested in the factory in the ordinary way, put on normal potential with a measured discharge passing through it. In the a. c. the leakage is about three-quarters of an ampere to one ampere. Then you put on double potential, dynamic potential right from the generator, and you will again measure the current that flows. You may find from the record that the actual current does go up to the volts given.

Now if the lightning arrester will take care of dynamic current for a

very considerable length of time, it surely ought to take care of lightning currents which exist for a very short time.

I thank you for your attention (Applause.)

President Tait: Will you enlighten the gentlemen on the method of salting grounds?

E. F. Creighton (Schenectady, N. Y.): The whole subject of making grounds on circuits was presented in a paper to the American Institute last June. We carried on tests covering a period of over two years now, with ordinary pipe driven into the ground, say take an inch pipe, drive it into the ground and measure its resistance and its permanence. We found that in very dry soil the resistance of such a pipe would be very high. We drove the pipes into mounds of earth. Where the pipe was not driven down to the level of the earth and the resistance was very high, up to hundreds of ohms, we took and cut out round the top of the pipes most of which were driven in 8 feet and put in there a few pounds of salt, then placed in the hole dug out a few buckets of water. From day to day we measured the resistance. You will find this all in the paper -- you care to look it up. We found every day that this resistance was decreasing as the water was percolating through to the underlying conducting strata. This ground has stood for about three years, and although the resistance has gone up somewhat, it is still very low as compared to the original condition, due to the fact that it is very difficult to wash salt out. We made extensive tests at a power plant where they have in their station two of the old-type grounds made by using about 2 feet square copper and covering that with a load of coke, having first dug a big hole and made a strong wire connection. We had two of those in the station, and the two of them measured in parallel 22 ohms. We drove five pipes on the outside of the station through gravel soil, connected these pipes all together and salted them down, and these 5 pipes which cost almost nothing and required only a few minutes to drive had a resistance less than half of the resistance of the two expensive grounds. Furthermore, they have the advantage of your being able to test them out any time you please, and you can always tell whether your ground is in good condition. The easiest way is to simply put a little salt on it, water it down and you are sure that the ground is all right; but if you do want to test it simply divide up your pipes which are best driven around the station on the outside, divide them into two parts and put 110 volts across the two sides with an ordinary meter, and in that way you can measure up the resistance. You can see that if the five pipes gave a resistance of 10 ohms that will give you about 10 amperes on 110 volts. In good wet soil the resistance of one pipe in the earth by itself will be about 15 ohms; if the soil is very dry it will run up to several hundred ohms; and if it is thoroughly salted down it will run down to something like 10 ohms per pipe. I can recommend that method both on account of its cheapness and the possibility of testing it out, and its durability. There is just one factor in regard to these earth grounds that you ought to take into account, and that is occasionally when you have a ground on a circuit or in some way

that the dynamic current has to flow into your earth connection you will find that it will not take more than two or three minutes for the dynamic current to so dry out the earth that the resistance may run up to several thousand ohms, and it may be weeks before the moisture gets back into the earth surrounding the contact and bring it back to its original condition; so that in that case if you should have a drying out effect due to a dynamic current you will have the advantage of treating your ground immediately with salt water and in that way bring it back to the normal low value. Of course one of the best grounds you can get is the water mains of the system because there you will have a very large area of surface and less liability of drying out. I thank you. (Applause.)

President Tait: We are very much obliged for your talk. We thoroughly appreciate it. If there are no questions or argument on this matter I would like to suggest that Mr. Turner has something to present to the Association at this time.

M. E. Turner (Cleveland): (Mr. President, I want to present an amendment to Article VII, Section 7, to the constitution, to be acted upon at the next convention, which is as follows:

PROPOSED AMENDMENT TO CONSTITUTION.

Offered by M. E. Turner, Cleveland, O.

Article VII, Section 7.—A nominating committee of five members shall be chosen at each annual meeting and in the following manner: Two members to be elected by the Association, two members to be the two retiring members of the Executive Committee; and one member to be appointed by the President and to be Chairman of said committee.

The elected members of the Committee shall be chosen thus: In open convention the delegates shall nominate members for election to the Committee, and all members so nominated and supported by a seconding motion shall be the nominees for election; and of these nominees the two receiving the highest number of the votes of the Association shall be declared duly elected. The polls shall remain open five minutes, and no other business shall come before the Association during such interval of time.

President Tait: I would ask that action be now taken on the report of the Nominating Committee that came in this morning. We have a few minutes before we close, in which we can get that disposed of. What action do you want to take in the matter of the Nominating Committee's report? I believe it is on the table for consideration.

M. E. Turner (Cleveland): Mr. President, I move that the report of the Nominating Committee be received and accepted, and that the Secretary be

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instructed to cast the ballot of the convention for the election of the respective nominees.

Which motion was seconded, carried, and so ordered.

The secretary cast the ballot accordingly, and declared the various nominees duly elected.

Announcement was made by Mr. Turner that arrangements had been made by Mr. Hanley to run a special boat after the banquet to Port Clinton and probably Sandusky, so that any who wished might take that means of getting an early start in the morning by rail from either of those points.

President Tait: This afternoon we will probably have a little time in which to take up the further discussion of the oil engine, gas engine and gas producer plants. A request has been made that that subject be again taken up if we have the time.

The Chair called for the report of the Auditing Committee, which was submitted as follows:

REPORT OF AUDITING COMMITTEE.

To the Ohio Electric Light Association:

Your Finance Committee herewith report that we have audited the books, bills and vouchers for the past year, and find all vouchers, bills, etc., balance with the Secretary's financial report.

Respectfully submitted,

W. P. ENGEL,

W. F. HUBBELL,

T. D. BUCKWELL,

Finance Committee.

On motion, the report was received and accepted.

On motion, an adjournment was now taken to 2:15 this afternoon.

FIFTH SESSION—THURSDAY AFTERNOON, AUGUST 27.

The convention met pursuant to recess. President Tait in the chair.

Mr. Fred Leslie, of the Muncie Electric Light Co., Muncie, Ind., read his paper on "Gas and Gasoline Lighting Competition and Best Ways to Meet It," as follows:

GAS AND GASOLINE LIGHTING COMPETITION AND BEST WAYS TO MEET IT.

..By MR. FRED LESLIE, of Muncie Electric Light Co., Muncie, Ind.

It seems to be a settled fact that a sufficient amount of illumination for a store can be produced with gas or gasoline arcs for less money than it can be done with the most modern electrical methods, if the current is to be sold at a reasonable profit to the central station.

When I say for less money I am considering the cost of the gas lighting to be the amount the user will acknowledge it costs him. Very few will allow such items as depreciation on equipment, destroyed decorations, loss of trade on account of heat, bad air, etc.

When we have admitted that the electrical method costs more, it is necessary for us to prove that it is worth more, or, by some other means convince the prospect.

The flat rate lighting plan with the use of Gem, tantalum and Tungsten lamps is very attractive to certain classes of consumers, especially saloons, restaurants and other business open until eleven or twelve p. m. and rooms which require daytime lighting. It is a fact that the majority of Central Stations are afraid of flat rates, and they have reason to be afraid providing the flat rate is not made high enough. As we have been able to displace a large number of gasoline plants by the use of flat rates I feel that an explanation of these rates will be interesting.

These flat rates were made about two years ago, when the Gem and tantalum lamps first came into general use. The price charged is made strictly on the number of lamps installed. For six o'clock closing business the price charged is 50c per month or \$6.00 per year, and for eleven o'clock closing, 60c per month or \$7.20 per year. The consumer in either case must use either Gem or tantalum lamps and furnish his own lamp renewals. The fact that he pays for renewals prevents to some extent the use of lighting when it is not necessary. This rate figures in the one case \$120.00 per kilowatt year and \$144.00 in the other—on the connected load. When you know that very few central stations average \$40.00 or even \$30.00 per kilowatt year income, this flat rate business cannot help but look good.

If the consumer uses his entire installation an average of eight hours per day the income per kilowatt hour would be about 5c. And to take the extreme case where the lamps would be used continuously the income per kilowatt hour would be close to two cents which is a good rate on business with a load factor of 100 per cent. We have been able to produce a yearly income of \$135.00 per kilowatt peak, which by comparison you will find to be high. We do not believe that this result is often obtained by a strict meter system.

The Tungsten lamp offers a still better proposition on the flat rate than either the Gem or tantalum. This is from the fact the consumer gets almost

double the light for the money and less energy is consumed to produce it. We are putting out the 100-watt lamp on a flat rate of \$1.50 per month; the 60-watt at 90c and the 40-watt at 60c, regardless of hours used. This produces an income of \$180.00 per kilowatt year connected. The original installations and renewals are furnished by the consumer. If the consumer were to use the 100-watt lamp on a meter he would reduce the hours burning to an average of six per day which would net about 75c per month at a 5c rate.

We have had some consumers that were using tantalum lamps on flat rate and have changed to Tungsten, and in every case we were able to hold the income up to where it was and to increase the candlepower to nearly double and reduce the current consumption.

One great advantage of flat rate lighting is the elimination of all meter troubles, such as high bills, errors in reading, attempts to beat the meter, etc. Disputed accounts lead to the loss of a friend and very often to the loss of a consumer. With a flat rate charge for lighting the consumer knows what his bill will be and makes it a part of his fixed charge the same as rent, clerk hire and other regular bills. The flat rate charge being divided equally throughout the year helps to reduce the slump in income during the summer months. Flat rate lighting also saves the investment in a meter, the cost of repairs and testing the same and the expense of meter reading and computing the bill.

It was not the intention in this paper to devote much space to the question of rates; while we will admit that the rates for current have something to do with a successful campaign against gas and gasoline competition, the greatest factor in the fight is the public policy of the company. I may state, as an explanation, to what extent this idea has been carried out in our city, that the writer as superintendent of the Lighting Company was some time ago elected President of the Merchant's Association and is holding the office at the present time. This association is composed of about 75 of the leading merchants of our city who are all heavy consumers of electricity.

The benefits to be derived from this amount of public confidence in the manager of a central station are very apparent. While it is easy to see the advantage of this condition the method of its attainment is the problem. The solution is, not by any fixed rule, but by conducting the business in a manner to merit the position. The people must be treated in a way that their expression will be favorable to the company. It is not always convenient to give time to traveling men but we have found it pays to do so. You are almost sure to learn something new, and to have them speak well of you is worth the time necessary to give them an audience. In the settlement of disputed accounts the amount is most generally small and if you can satisfy a customer and make him your friend for 63c or \$3.63 rebate on his account, if there is any possible excuse for allowing it, it is money well spent, and a small price to pay for his good will.

When you start up town to buy an article you generally hunt some friend to get it from whom you are satisfied will give you a square deal. The same way with the man hunting a satisfactory system of lighting his store, if he

thinks he can get a square deal from the Lighting Company and knows the manager as he should, your chances are good to get his business.

It is necessary to take an active part in all commercial and industrial associations. It not only shows the spirit of interest in your city but enables you to become acquainted with all new comers to your city before they have located and to have a chance at their lighting before they have decided on gas or gasoline.

Drug stores seem to be, or have been with us, the hardest to wean away from the gasoline lighting plant. They generally get their gasoline at wholesale which reduces their cost from 15 to 20 per cent. They can also get along on a poor quality of light and a poor quantity if necessary. We have recently displaced two gasoline plants with a flat rate Tungsten proposition by soliciting the assistance of the drug clerks. It is the rule that the care of these plants is up to the clerks. The work of cleaning and operating is far from pleasant or desirable and the aid of the clerk to get rid of the thing can easily be secured. In the case above we do not believe the contract would have been signed without their influence. The same will apply to other stores as well.

There is one mistake in flat rate lighting and long hour meter business that is very easy to make, and that is of selling the customer more light than he can afford to pay for. It is true that it is his business how much he spends for light, but it is your business, not just to get in the original installation and two or three months bill, but to get a permanent, satisfied customer. If there is not sufficient light it is much easier to add on a few lamps than to have to take away some. After a part of the lighting is cut out he decides the balance is not doing any better than gasoline and back he goes.

The matter of furnishing the use of a suitable fixture free of charge has surely been a great factor in meeting this competition in our city. With the Gem and tantalum lamps we have used principally the Harter wireless glass cluster with flat porcelain reflectors. The cluster is provided with a pendant switch making it convenient, and saving the cost of wiring for a side wall switch. These clusters can be installed in a room that has only one circuit through the center or one row of outlets without any cost for wiring. It has been our custom to install the cluster but not to do any wiring.

We have not as yet decided on any regular outfit for the use of Tungsten lamps. The single pendant supported by lamp cord is inexpensive and gives satisfactory results with the 100-watt lamps. We have in every Tungsten installation employed the use of holophane reflectors. We believe it is not only good policy to use this glassware, but that it is necessary to do so to establish a standard of illumination that will successfully compete with gas and gasoline arcs.

Discussion.

President Tait: Gentlemen, this paper has presented ideas on handling current that I think are new to the average central station, and I am satis-

tioned that Mr. Leslie is prepared to defend his position on the subject. If there are any questions you want to ask about it start right in. It is quite unusual, you know, to sell current on a flat rate that way.

H. W. Chase (Dayton): I understand that there are some companies here that are installing their Tungstens on a flat rate charge for renewals, and others are installing them and covering the cost of the renewal in the flat price. I would like to know which method proves most satisfactory.

President Tait: I believe Mr. Anderson carries on a similar scheme. We will be glad to hear from him.

W. C. Anderson (Canton): It has been so long since I have not been connected with lighting companies that were supplying current on a flat rate that I would almost as soon think of defending the meter plan as of defending the flat rate plan. I think it defends itself. In the Hoboken plant with which I was connected from 1889 to 1899 we lighted by flat rate almost exclusively, and we did more business in Hoboken, with a population of about 40,000 than our neighboring city of Jersey City did with a population of 175,000, although the conditions were at least as good or possibly better there for lighting, than they were in Hoboken. Now I do not believe that a person can make any set rule for furnishing or not furnishing renewals. I believe that that is something that should be best worked out by the individual plants. If you were furnishing lighting with a very low renewal cost, incandescent or arc lamps, you could afford to take a great deal more chances of the customer letting the lights burn carelessly than though you were supplying a very expensive renewal proposition like the Tungsten lamps. I would not be prepared to say as yet whether the Tungsten lamps would have sufficient light to justify taking chances on wasted current, or not. I do not see why they should not though, because as I understand it, the light is very good. Our experience so far has been that their light is very good, and we use them at a little below voltage; that is, a voltage very considerably below the marking of the lamp, about five volts. I presume that that has a tendency to cheapen the renewals considerably. I do not know that there is anything that I can say that would be of further interest. If there are any questions as to the rates we charge I would be glad to give any information.

H. W. Chase (Dayton): What rate do you charge, Mr. Anderson?

W. C. Anderson (Canton): Our rate for a 16 candle-power lamp is 60 cents. We have not gone into the Tungsten lamp far enough to develop any permanent rates. What we have done is a little more in the trial order than anything else.

President Tait: Is there any further discussion on this paper?

J. R. Cravath (Electrical World): There is one other possibility in connection with flat rates that does not seem to have been considered; that is the giving of a flat rate and letting the consumer furnish his own renewals on Tungsten lamps, the idea being that the cost of renewals would be high enough to induce him not to keep his lamps on when he didn't need them; in fact, that possibility was discussed not only for store but for residence light-

ing over at the Michigan meeting last week. In connection with residence lighting the advantages offered would be mainly in reduction in cost of supplying service—first cost—and also if some kind of a flickering device was used instead of a meter it would tend to reduce the consumer's maximum demand; that is, he would contract for a certain maximum number of lamps which would be considerably less than the number that he would use under the regular meter rules, and in that way the investment cost per consumer would be kept down. That was a suggestion made by Mr. Dow as something worth thinking about, although I notice that he has not tried it yet.

President Tait: I would like to ask the advocates of the flat rate scheme what seems to be the tendency as to the customer wasting current; in other words, do you know definitely, or have you any idea about what percentage of total current burned is wasted by allowing it to go beyond the hours that you contracted to supply it; in other words, if you have a contract to furnish electric light to midnight at a price of so much per unit, what assurance have you got, how do you correct the difficulty of a man burning the current all day and all night, not turning it off? Some will do that. We have had a long experience with flat rates in various places, and have always had to finally install meters, unless we could get a very high rate on k. w. capacity of lamps connected. We have not done very much of that sort of work in recent years, but I am highly interested in knowing that it is being done so successfully elsewhere. I would like to know what the tendency of human nature is in that respect in the towns that you gentlemen represent. Canton and Muncie, to burn lights longer than the contract period? The question of carbon filament lamps burning out is not a serious question with him because he can buy lamps comparatively cheap. Of course I can see how the Tungsten lamp at a high cost would act to his detriment, but I would like to know the definite proportion of current that is being wasted, and how it works out in that respect. Can any of you tell me that?

W. C. Anderson (Canton): I would say that as far as Canton is concerned that there is a very considerable amount of light used unnecessarily on a flat rate. We furnish lamp renewals on practically all those contracts. Further than that, we do not use anything at all except G. E. M. lamps even for our ordinary renewals. We do all our contract work practically. In most cases we have installed meters by which we check up the amount of waste, and our situation as regards waste is not very different from that of any other place. For a good part of the year we have a heating system in connection with our lighting business, and practically all this waste is in such hours as the current costs us the least; in other words, this additional current wasted by the consumer is a very, very small item with us, and in making our contracts although we limit them all to a certain number of hours average use per month or per day, if they use too much above that we send them a bill and make them pay it at meter rate.

J. W. Beam (Cleveland): I would ask Mr. Anderson if he notices any

appreciable difference in the color of the light from using lamps five volts higher than the voltage delivered?

W. C. Anderson (Canton): I have not compared the two lamps together to notice. The lamp looks perfectly good enough at five volts below its marking. It is plenty bright, while there is probably 18 per cent less light. I think I tried to bring out that point this morning, that in introducing Tungsten lamps I looked at it as very essential that you increase the current consumption as much as possible. While we are selling light and not current, yet we are getting paid on the basis of current.

President Tait: What are the conditions at Muncie in that respect?

Fred. Leslie (Muncie, Ind.): The tendency has been, of course, to a rather free use of current. After they close up their places of business they do not leave them lighted up except perhaps one light burning all night. I believe the cost of that much extra current is paid for by the advertisement. People see those lights burning and it has a tendency to advertise the electric lighting business. We have a heating system the same as Mr. Anderson for seven months in the year, and lighting off the peak does not cost us anything, because we have to furnish steam anyhow; and in the summer time there is no tendency to waste the light. People do not like to stay in those places so it seems to me to work out very satisfactorily.

President Tait: Does your company maintain any sort of supervision over the burning of those lights? Do you have a man go round and see what is going on and how the various stores are burning the light?

Fred Leslie (Muncie, Ind.): The only supervision is on the connected load. Once in a while they will add a lamp or two. We have to do a little missionary work on that line; but so far as hours of use is concerned we absolutely pay no attention to it. They use what they want, just as they would water.

President Tait: Would either of you gentlemen continue on that flat rate method if you had not steam heating attached to the stations? It appears to me that both of you seem to indicate that the heating system is the missing link. Would you follow the same method if you were not disposing of steam heating as a by-product?

Fred Leslie: We would give a little closer attention to the hours of burning, but the rate method would be the same.

W. M. Adams (Elyria): I had occasion in the town of Fremont where we took a plant over, to make a canvass of the town and see how many lights were burning on flat rate. We found there were 1,700. In several places they were paying for 6 lights, and they had 13. After we threw it on meters we didn't have 750 lights. I think by the hot water waste steam system they are robbing Peter to pay Paul. I would say, stay to meters.

E. A. Lechstein (Sandusky): We have a little plant in our neighborhood, about fourteen miles from home, where they have a flat rate system. It is a municipal plant. They have only a night service. If you will stand on the main street when the machinery starts up at 4:00 o'clock you will

see every light burning. If you are there when they shut down in the morning, they all go out, just because the machinery stops. The only fellow who is busy around there is the fireman—and he is real busy!

W. C. Anderson (Canton): I never did and never would make a flat rate for a private house or any place where the lights are not in plain view from the street.

President Tait: That is just the information I want. I would like to know the limitations of the flat rate business. I have never been able in my own mind to believe that a strictly flat rate is the proper thing. If it had been we would have never bought meters 10 or 15 years ago and kept on buying them since. As I understand it this flat rate scheme is chiefly confined to the business houses in a town where you can observe what is going on, and if a man does abuse the light you have a chance to get back at him and charge for the wastage. That is the principle, is it not?

W. C. Anderson (Canton): That is it precisely.

B. H. Gardner (Dayton): For what number of hours is that rate of 60 cents a month, and is it stated in the contract that they will be charged additional if they use current more than that number of hours?

W. C. Anderson (Canton): The contract is drawn that the lighting shall be from such and such an hour to such an hour and during dark and cloudy weather only, and that it shall in no case exceed so many hours a day. If any excess is used over such hours it shall be paid for at the rate of (blank) cents per k. w. hour, whatever the hourly rate is.

E. A. Bechstein (Sandusky): I supposed the 60 cents per month would be the rate fixed as an average the year around. I would like to ask the gentleman how he would handle a customer that only wants electric light about six months in the winter and is willing to get along without it and use something else in the summer. Must such a customer pay you for a whole year, or do you let them come on your service and get off whenever they want to?

W. C. Anderson (Canton): Well, I would say that I would get all I could out of that man. If I thought I could get more on a meter rate I would certainly put him on meter; but a man who uses electric light only in winter and is willing to get along without any light in the summer time is a pretty hard man to deal with. If he is willing to get along without any in the summer time he is not willing to pay very much in the winter time; and I think that a meter would be the proper thing for him; in fact, I do not think that the flat rate proposition is for any one except one who wants to have a nicely lighted store, and you can get more money from him by a flat rate, and he can get more light from you that way, and you will both be satisfied.

President Tait: There are two things I would like to be satisfied about; I would like to know from your experience what the average price per k. w. hour seems to figure out on your flat rate basis of lighting. I would like to know approximately what the average seems to be as against other plants; also, is it not a fact that if the flat rate was carried to great extreme in your

town that it would mean additional generating apparatus, which is what we found in years gone by we would save by installing the meter system?

W. C. Anderson (Canton): From an experience in flat rates for twenty years I would say there is no more apparatus needed, limiting that of course to what I said before, that no light would be on a flat rate except it was a light that was used during the day, and none at all in offices or houses, or any place where the light could not be seen, or where its use would naturally be intermittent. I do not think that the receipts that we have per k. w. hour should be taken as a fair comparison. We have just passed through a very bitter and destructive competitive fight, and we handle it very largely on the flat rate proposition.

President Tait: May I ask Mr. Leslie what the average price per kilowatt hour, if you have figured it, works out on a flat rate basis—if you care to make the statement publicly?

Fred. Leslie (Muncie, Ind.): I do not care to make any additional statement otherwise than in that paper. There has been practically but little of the Tungstens in use there because it is comparatively new; but on the tantalum and Gem lamp that would be just as stated in the paper. In regard to lighting stores I might say that we never put out any flat rates among the residences, although if a man wanted twenty lights in his residence for 60 cents a month I would let him have them; but we have not found any that wanted them, because \$12 is too much to pay for a residence a month. It is confined to the stores in the down town districts, and you can patrol that yourself as far as that is concerned, to see whether they are keeping the contract.

W. P. Engel (Defiance): I take it that it is purely and simply up to the manager and his assistant as to what lighting in his judgment he takes on by contract. I should say that when a man wants lighting it is a matter of judgment whether he shall be supplied by meter or by contract. On a contract price you want to control the light to suit yourself. You have to find out how careful the man is, and make him a price accordingly? He will feel satisfied if he is under no restriction, and he will use a little more than what he would naturally on a meter. So that it is entirely up to the manager and his assistant to whom he shall give these flat rates.

President Tait: Mr. Osborn, have you anything to say on the subject? You have been around various companies, I believe?

G. C. Osborn (Harrison, N. J.): One or two ideas came to my mind that are derived from several experiences that have been related to me. One case is at Atlantic City, where they are using a flat rate on the Tungsten lamp, taking a very cheap fixture and making out of it a one, two, three or four light fixture; but they are only putting these lamps where they can be seen plainly, and they specify that the lamp shall be turned down at dusk, and turned off at least by midnight, as I remember it. The store-keeper is put on his honor to do that; if not, they reserve the right in the contract to cancel it. The question that I would like to ask is whether it has made any

difference in the number of meters that Muncie or Canton have used; that is, if a customer has part of his lamps on flat rate, and part on meters, whether it does not require just as many meters, and whether there is any saving in that department? The tendency I find all over the country is a desire to get away from the flat rate proposition. We have a particular case of flat rate in Hartford, Conn., where they are giving Tungsten lamps on a free renewal basis, and putting them out on flat rate without meters at all. In that case they limit the man's total load; but they have not gone into that to any extent.

President Tait: What device is that which is put on to make it flicker?

G. C. Osborn (Harrison, N. J.): It is an arrester that when you get up to a certain load will by means of a snap-switch break the contact, and the man will have to remove a certain number of lamps to keep it down. I obtained that information in an indirect way, that they go to a customer and take his bills for the previous year from month to month and offer to do his lighting on that basis with a Tungsten lamp, guaranteeing him that the bill will be 20 per cent less than last year. Then they put in Tungsten lamps, reducing his peak in that way and running the load over 6 or 8 hours. That has only been in operation about two months.

Fred. Leslie (Muncie, Ind.): It seems to me that the advantage to be gained from the Tungsten lamp is to give the consumer more candle-power instead of a smaller bill. If you put lamps on meter you will have to reduce his current consumption. It is not policy to reduce the rate, so there is only one thing to do, and that is to reduce the income. If a flat rate will hold up the income it looks like it is better than meter to me.

T. D. Buckwell (Toledo): In regard to Tungsten lamps, if you reduce your load by Tungsten lamps do you not think it is possible to get more money out of three customers than you are getting out of one now? If you use Tungsten lamps, with the same amount of machinery and the same investment that you have at the present time I believe it is possible to get more money out of three customers than it is out of one.

Fred. Leslie (Muncie, Ind.): It depends in a case of that kind a great deal on the extent to which lighting is done in the town as to the income per capita. You may get to a point where there is not three there. We are getting about \$7 per capita in our town, and we have not got the three to work on.

G. H. Stickney (Lynn, Mass.): It seems to me that this cheapening of the light is not going to make any permanent reduction in the income of central stations. A little break is to be expected which may be considered pretty seriously by your Board of Directors at the time, but with the cheapening of the light there must necessarily come a raising of the standard; for instance, as the current gets a little cheaper one store after another will take advantage of that and light up stronger, for if one store looks considerably darker than its neighbor the fact is quickly observed, and the proprietor will fall in line. I think that has been the experience in a great many cases. I

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observe that in making the rounds from one city to another, when one store lights up a little bit stronger than anybody else has been doing, complaints come in from the other fellows that their lamps are not doing well, and when the reason is explained to and understood by the party making the complaint, he will come up to the new standard established. There is no question but what lighting standards are increasing very rapidly. Another point too in connection with that is, we all know that electric lighting is reaching a very small percentage of its possible field. It has not extended throughout the country or to residence lighting nearly as thoroughly as it can, and these newer units will not only help in competition with gas, but the result will be a general extension of electric lighting and a raising of the standard in a great many places that never have been reached properly before.

A Voice: Do you use meters on flat rate, Mr. Leslie?

Fred. Leslie (Muncie, Ind.): I do not install meters on flat rate. We do not make those contracts at all.

G. C. Osborn (Harrison, N. J.): Does not that limit the consumer so that he cannot put lights where he wants to use them?

Fred. Leslie (Muncie, Ind.): Flat rates would not apply to a condition such as you speak of. Those lamps are only used in small towns.

W. M. Adams (Elyria): I think you will all agree that it has been the history of the lighting business that the more light a man gets the more he wants. I remember back in the early days when I first started in arc lighting we had the Gas Company to compete against and we installed Thomson-Houston open arcs. We of course had a flat rate. We had full control of them, shutting them off at 12:00 o'clock or 10:00 o'clock. The Gas Company immediately established a flat rate in all business houses and told them that they would give them so much gas per year. They did not take out the meters, however. As a consequence in about four years the Electric Light Company owned the Gas Company. They were not getting 25 cents a thousand for their gas. We examined their books after we took possession of the Gas Company.

F. W. Willcox (Harrison, N. J.): One thing about the Tungsten high efficiency lamp has perhaps not been given full consideration, and that is the relative cost per candle power of producing light in comparison with carbon lamps. If you figure out the differential costs of producing an equal amount of illumination with the different forms of lamps you will find that the Tungsten will amount on the ordinary demand of three or four hours per day per lamp to about 40 per cent of what it will cost for a carbon lamp of 3.1 W. P. C. That is something that should be of value to central stations. Of course you are not selling by the candle power hour; unfortunately you are selling by the k. w. hour; but it shows the possibility of increased illumination from the same amount of apparatus. Many central stations are not doing more than 25 per cent of the total lighting business of a town, and the other 75 or 80 per cent is a possibility for the Tungsten to develop. It seems to me we should look to the possibilities of securing this additional business

rather than the effect upon the business that is at present in hand. I have been very much interested in the plan and methods of Mr. Leslie, and have always wondered how far his system could be practically applied. The consumer will gladly pay a lump sum for a given illumination which he would not pay at all on a meter basis. The difficulty is to limit him to the agreed demand. I wonder how it would be to take customers on that basis, have a meter installed so that he would know that you have a check on his actual consumption though you would not always hold him definitely to it, he could exceed his consumption one way or the other, still he knows that the meter is on there and so would not be apt to abuse the contract under which he was operating as he would be in the absence of a meter. If it would be possible to produce a lamp consuming only one-tenth watt per candle I think we would all agree that it would be very difficult to sell light by k. w. hour. While that is not a possibility of the immediate future, it has perhaps a bearing on the point as to what is the most practical way to sell illumination. The k. w. hour has a great many serious objections. It might come to a case where you would take the contract to light a man's place just as the water companies furnish water on a certain definite basis of so much illumination for a given number of living rooms, which can always be calculated to mean an average consumption of light per room, and restrict waste by the use of a meter device so that the customer will not exceed his guaranteed amount.

W. C. Anderson (Canton): I think Mr. Willcox has stated something that is very desirable, and something that is very likely to be realized in the future. We are making and have made such contracts, a great many of them, for flat rates per year, of course calling for monthly payments with a guarantee that not over so many k. w. hour shall be consumed; and I think that in most cases that they can be limited with a fuse, and that is the cheapest way that it is possible to deliver the service. The cost of current per k. w. hour by people lengthening out their hours of service is not a serious matter. Many put in a 50 candle-power lamp where they should have an 8 candle-power and that has been done a great deal in the past. If the lamp companies should still continue to charge the same price for the Tungsten lamps, why the consumers will not be anywhere nearly so liable to make such changes as they have been as to the carbon lamps in the past.

President Tait: Is there anything further on this subject? The time is going along. Several of the members have suggested that they would like to ask some further questions on gas producer plants and oil and gas engines. If there is any of that work that is incomplete, or any other question that you want to ask on that, now would be a proper time for taking it up; but let us limit the discussion and get through with it as soon as possible. If there is nothing on that head I would like to know if there is anything further that should come up at this meeting before we finally adjourn?

T. D. Buckwell (Toledo): I would like to make a suggestion, that we have a committee to be termed the Public Policy or Publicity Committee, to

report at the next convention. I think that is a subject that needs considerable attention, and is going to be given attention in the future.

President Tait: Do I understand that you suggest a committee in addition to the committee that has already been elected for next year?

T. D. Buckwell (Toledo): I did not know that had been done.

President Tait: There is a Publicity Committee. I would ask the Secretary if he has anything further?

Secretary Gaskill: I know of nothing else.

President Tait: Before we adjourn I want to take this opportunity to thank each and every officer and every individual member of the Association who has helped along in any way to make the convention this year a success. I hope that everybody who has been here will derive benefit from the meeting. It is gratifying to us all to know that we have had a larger attendance from central stations in any previous year in the history of the Association. Put-in-Bay is a hard place to get to, and the large attendance here indicates the great interest that has been taken in the Association work. This is as it should be, and I hope that it will continue and that the attendance will grow larger every year hereafter.

Secretary Gaskill: From the standpoint of the Secretary I want to second what Mr. Tait has just said about the help that we have had from the central stations of Ohio. I want to further ask that all those who are in attendance this year will give their help and assistance toward bringing out a still better attendance next year. Now work of this kind is just like getting any other business; you have to go after it and get the people to realize that it pays to come to the convention. The President and Secretary can do much along this line, but their work is made a great deal lighter if you will all co-operate in that regard and urge other plants, not only members but non-members to come out and help swell the crowd and take part in the work. If you will all do that during the year we will have a bigger convention next year than we have had this year. We have had a better convention this year than last, and we had a better one last year than we had ever had before. We want the assistance and co-operation of all in this work.

It is a source of great satisfaction to the officers, and I presume of as great satisfaction to the members that the Ohio Association is by far the largest state organization of electrical men in the world probably, and next to the National in its importance. This is a source of pride to all of you, and by your help and assistance in the future, as you have given it in the past, we will continue to maintain our reputation.

President Tait: If there is nothing further, a motion to adjourn until our meeting next year will be in order.

The convention adjourned accordingly, the place and date of the next convention to be hereafter determined by the Executive Committee.

APPENDIX.

The Ohio Electric Light Association would call the attention of its members and friends to the fact that the Association has during the past two years issued in advance of its convention a very handsome souvenir program of the annual meeting. This work has been the product of the highest development of printers art and the Association will continue to issue such souvenir in advance of its annual meeting. The publication is maintained by the advertising contained therein and the entire profits of the publication is devoted to the entertainment of those attending the annual convention. The Association would ask that its members and friends remember the advertisers that have so kindly assisted in making this publication a success.

The following are the advertisers in the programme of 1908:

Wagner Electric Manufacturing Co.....	St. Louis, Mo.
The Jandus Electric Company.....	Cleveland, Ohio
The George Worthington Company.....	Cleveland, Ohio
The Ambos-Cudmore Company.....	Cleveland, Ohio
Western Electric Company	St. Louis, Mo.
The Globe Electrical Company.....	Dayton, Ohio
Westinghouse Electric & Manufacturing Co.....	Pittsburg, Pa.
The Cleveland Electric Illuminating Co.....	Cleveland, Ohio
General Electric Company.....	Schenectady, N. Y.
The Indiana Rubber & Insulated Wire Co.....	Jonesboro, Ind.
National Carbon Company.....	Cleveland, Ohio
Union Electric Company.....	Pittsburg, Pa.
The Libbey Glass Company.....	Toledo, Ohio
The Banner Electric Company.....	Youngstown, Ohio
The Moffat Feed Water Heater & Purifier Company.....	Dayton, Ohio
The Brownell Company.....	Dayton, Ohio
New York & Ohio Company.....	Warren, Ohio
The William Hall Electric Company.....	Dayton, Ohio
H. W. Johns-Manville Company.....	Cleveland, Ohio
Century Electric Company.....	St. Louis, Mo.
The Phoenix Glass Company.....	Pittsburg, Pa.
Pittsburg Transformer Company.....	Pittsburg, Pa.
Fort Wayne Electric Works.....	Fort Wayne, Ind.
Hugo Reisinger.....	New York, N. Y.
The Sanitary Pump Company.....	Dayton, Ohio
Allis-Chalmers Company.....	Milwaukee, Wis.
The Toledo Railways & Light Company.....	Toledo, Ohio
The Electric Storage Battery Company.....	Philadelphia, Pa.
The Adams-Bagnall Electric Company.....	Cleveland, Ohio
Doubleday-Hill Electric Company.....	Pittsburg, Pa.
Gregory Electric Company.....	Chicago, Ill.

The Buckeye Electric Company.....Cleveland, Ohio
 The Ideal Electric & Manufacturing Company.....Mansfield, Ohio
 The Toledo Electric Company.....Toledo, Ohio
 The Economy Electric Company.....Warren, Ohio
 Shelby Electric CompanyShelby, Ohio
 Ridgway Dynamo & Engine Company.....Ridgway, Pa.
 Invincible Electric Renovator Sales Company.....Cleveland, Ohio
 The Dayton Fan & Motor Company.....Dayton, Ohio
 The Toledo Chandelier Manufacturing Company.....Toledo, Ohio
 The Cleveland Electrical Supply Co.....Cleveland, Ohio
 The Erner Electric Company.....Cleveland, Ohio
 The Arbuckle-Ryan Company.....Toledo, Ohio
 Electric Appliance Company.....Chicago, Ill.
 Columbia Incandescent Lamp Company.....St. Louis, Mo.
 Moloney Electric Company.....St. Louis, Mo.
 Wm. Wurdack Electric Manufacturing Company.....St. Louis, Mo.
 W. G. Nagel Electric Company.....Toledo, Ohio

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